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CONTENTS

EDITORIAL:
Editorial Notes ... 189
Canadian Reciprocity as Affecting New England ... 191
Preventing Collisions by Statute ... 192
The "League for Public Safety" and Railway Accidents ... 193
New Books ... 194

ILLUSTRATED:
Development of the Western Maryland ... 195
The Supply Department ... 201
LETTERS TO THE EDITOR ... 194

MISCELLANEOUS:
Two Studies of Railway Capitalization ... 198
Studies in Railway Economics ... 200
Statistics of Express Companies for a Year ... 207
Increases of Earnings and Expenses of Eastern Railways for Five Months ... 208
Foreign Railway Notes ... 199
GENERAL NEWS SECTION ... 247
SUPPLY TRADE SECTION ... 260

SHOP SECTION.

EDITORIAL:
Editorial Notes ... 209
Scientific Management ... 210
Mechanical Articles During January ... 211
Standardization of Chilled Iron Car Wheels ... 211
New Books ... 215

ILLUSTRATED:
Shop Kinks ... 217
Standardization of Chilled Iron Car Wheels with Reference to Service Conditions ... 239
Increasing Shop Output ... 243
Stepped Cylinder Arrangement for 4-6-4 Locomotive ... 246

LETTERS TO THE EDITOR:
Scientific Management ... 212

MISCELLANEOUS:
Increasing the Output of a Locomotive Repair Shop ... 215
Electrification of the Shop of the Wabash Railroad ... 216
Large Locomotive Mileage ... 216
The Mistakes of the Efficiency Men ... 230
The Use and Misuse of the Scrap Pile ... 231
Fixing Pencil Lines ... 232
Apprentice Instructors' Conference; New York Central Lines ... 233
Aluminum in Car Construction ... 239
How to Get the Most Work from Men and Machines ... 245
Foreign Railway Notes ... 229, 245, 246

AN extensive reorganization of the Rock Island Lines was put in effect on February 1. Under the new organization there will be a marked decentralization of management. The lines have been divided into three districts, and, whereas the old organization was departmental, the new organization is frankly divisional. The following official memorandum both gives the reasons for the change and describes its nature:

"The principal reason for the change in organization was the desire to furnish better service to the public. The first requirement is a decentralization of authority heretofore held in Chicago. On each of the three districts the general manager will be supreme on all matters local to his district and, with co-ordinate officers in the freight and passenger departments, will keep in touch with and meet service conditions promptly by frequent conferences. In the operating department, both the general superintendents and division superintendents will have on their staff the mechanical and engineering district or division representatives. The plan is a divisional one wherein the superintendent is responsible for all operations on his territory, but the organization of the general superintendent's force differs from that of most roads having divisional organization. He will have a superintendent of motive power and an engineer of maintenance of way reporting directly to him on all operating matters, and in this way the control of each general manager's district is centralized in the general superintendent, who will be responsible only to his immediate superior, the general manager. For purposes of maintaining uniform practice and standard methods, the mechanical and engineering district representatives will be advised by the system officers."

Further details of the reorganization are given in our news columns. It is an interesting example of the tendency of the managements of large railway systems to recognize the dangers of excessive centralization of authority and the desirability of giving divisional and district officers the staffs and the authority necessary to enable them satisfactorily to handle all matters pertaining chiefly to their own divisions or districts.

SOME weeks ago President Mellen of the New York, New Haven & Hartford in an unofficial letter suggested a court of commerce in Connecticut as a substitute for the proposed new public utilities commission in that state. The bill embodying that idea and, presumptively, fathered by the New Haven company, has now been introduced in the lower house of the state legislature. Its force of statement of the jurisdiction of the new tribunal is so unique as to be worth exact reprint.

Section 5. It shall be the duty of all persons to abstain from all acts unreasonably endangering the public health or safety. It shall be the duty of all employers to adopt reasonable measures to prevent injuries from the conditions of their employment to the health and safety of their employees. It shall be the duty of all railway companies, water companies, telegraph companies, telephone companies, and express companies, and of all other corporations, associations, partnerships and persons, who also serve the public, to render to the public such proper and adequate service, including the provision of reasonable facilities therefor, as shall be reasonable and just and reasonably compensated under the then existing conditions that shall actually exist; and it shall be the duty of all who supply or serve the public to refrain from extortionate, unjust and unreasonable rates, charges and prices for the commodities supplied and services rendered to the public.

The construction and functions of the court are also novel in many respects. An additional superior court judge, besides the existing eleven in the state, is to be created. Then any one of the twelve is to be appointed by the Connecticut chief justice to be a court of commerce for a year, that is to have all the power of an ordinary judge of the court and more, for he can regulate procedure and suspend the rules of evidence; he can employ an expert adviser or advisers; he may appoint a committee of investigation; and he may enter any order, decree or judgment which he thinks fit as calculated to carry out the intentions and spirit of the law. Any individual or party may bring a case before the judge without the intervention or initiative of an attorney should they prefer to do so. Appeal is given from the court to the supreme court of the state under the ordinary appellate form of procedure—but only on questions of law, not of fact.

THE novelty, not to say radical originality, of the single headed court is obvious. Its jurisdiction would reach out broadly to public hygiene and include "all" employers of labor, whether corporations or otherwise—matters hitherto voted beyond the purview of public service commissions. Whether its powers would extend to finance and capitalization is not clear, but presumptively they would, as any one of the judges might hold the theory that capitalization bore on rates and forbid, for

example, a new issue of stock. The court, apparently, would not possess initiative and would take up a case only on complaint, which in one sense would leave the corporations considerable freedom of action but might, in another sense, subject them to purely vexatious procedure. Seemingly it would be a kind of court of redress, yet with powers which extend beyond mere redress and into positive judgments relating to public equity, necessity and convenience, in the largest meanings of those terms. The fate of the measure will be watched with interest in a state where the question of a strong public utility commission has now for four years been an active issue in politics, with the platforms of both parties in the last political campaign indorsing it, and an outcome just possible is the creation of the court as a quick appellate tribunal annexed to such a commission. Meanwhile an antecedent fact may be emphasized. Connecticut has had for forty years or more a railway commission with plenty of law behind it, but wretchedly weak in personnel, policy and action. Had its composition and character been the reverse, would we now be hearing of commerce courts and of public utilities as a topical question in state politics?

THE post office appropriation bill, which is now being discussed in Congress, has a clause (page 20, H. R. 31, 539), which, if adopted, will require the universal use of steel mail cars by July 1, 1916. A provision in the bill requires the post office department at once to adopt specifications for steel cars, to which all new mail cars must conform, and there is a further proviso that, from the date of the passage of the bill, the government must refuse to pay rental for any wooden mail car which is run ahead of a steel car in any train. That is to say, if there were steel passenger cars in a train, the mail car, if not of steel, would have to be put at the rear of the train. As the larger railways have long been in the habit of giving the post office department about everything that it wanted, it is not unlikely that this demand will have to be complied with—though to do so will entail a heavy expenditure. Most of those mail cars which will not in the ordinary course be retired within five years are costly vehicles, and cannot be altered to be used for other purposes except at a large loss. The troublesome part of the proposal, however, is that which is designed to stop the mixing of steel and wooden cars in the same train. Many roads, even of those which do not own steel cars, would feel the effect of this, for the Pullman Company has a good many steel sleeping cars, which run over other roads than the Pennsylvania, and which it may at any time wish to send over an unusual route. To run a single steel sleeper at the rear of a long train would incur the penalty of this proposed law. By and by the practice of running mail and baggage cars at the rear of trains, now quite common in a limited territory, may have to be made universal. To think of every train being run with a blind end car at the rear—like a mole being dragged by the tail! Thus the real poetry of railroading will be one step nearer its final extinction. And the brand furnished by Mr. Brandeis and that ilk can never take its place.

EIGHT years ago E. W. Winter came to the Brooklyn Rapid Transit to put it on its feet. Since leaving the presidency of the Northern Pacific in 1897 he had been active in various enterprises, because there had been greater need for his services than what he would admit to be his own need for a rest. He had for two years been a confidential adviser for the directors of the Brooklyn Rapid Transit, and when they realized that they needed him in active charge he took the office. Though it was expected that the work he would have to do would only take about six months, he really "enlisted for six months or the war," and he has seen it through. He resigned last week, taking advantage of a time when his work of reorganization is finished and the company is ready to go ahead with a policy of extension which he can leave in the hands of his fellow officers. Though he does not expect to retire from railway work permanently, he has no definite plans aside from the enjoyment of several months of the leisure he has earned. At the end of 1902 the Brooklyn Rapid Transit was almost hopelessly run down; track, cars, credit—almost everything was in the same shape, and the company was barely earning a surplus. The new president asked the directors for more and more money, and somehow they raised it. In the seven years which followed, $40,000,000 was spent on permanent improvements. Some $35,000,000 bonds were sold under par, with a loss of $6,500,000 in discount, of which all but $1,000,000 has been made up by earnings. Mr. Winter, so far as he could, got all earnings put back into the property and opposed dividend payments; the stock is now paying 5 per cent. However, his biggest work was not the physical rehabilitation of the property but its moral rehabilitation, and raising it to the plane of good repute in the eyes of the public. In 1903 the management was under a unanimous fire of public condemnation. The people were more than simply suspicious of the new regime. Over and over again the B. R. T. had been taken in hand by new managements promising all the service the public could ask, but each house-cleaning brought in seven devils worse than the first. Winning the respect and trust of the public, rather than the bringing about the physical development of the system, is what has taken years. Mr. Winter succeeded by giving the road's patrons good service, raising the standard of the employees and taking care of them, and, in the face of attack and abuse, convincing the citizens of his integrity and fidelity to trust.

OUR esteemed contemporary, the *St. Louis Globe Democrat*, commenting on a recent editorial reference in this paper (January 6, 1911, page 1) to the rapid growth of the commerce of St. Louis during 1910 in spite of the so-called "bridge arbitrary" of which some of its business men greatly complain, assures us this growth was entirely because St. Louis has a very strong constitution, and not because its freight rate adjustment is favorable. There is no doubt that St. Louis has a very good constitution. Its business men are able and enterprising. But our contemporary greatly exaggerates the disadvantages in freight rates that they had to overcome. As has been shown in this paper before, the total amount in the form of the so-called arbitrary on coal that the shippers of St. Louis pay to the Terminal Railroad Association each year is only about one-fifth of one per cent. of the annual value of their manufactured products. Surely, for a city having, as our contemporary says, a most robust constitution, a burden of one-fifth of one per cent. cannot be so very heavy. Furthermore, as we have pointed out before, the imposition of this very slight burden is entirely justified by the conditions under which coal is transported from points in Illinois to points in St. Louis. To offset the very slight disadvantage, growing out of its geographical location, of which St. Louis complains, it has many and great advantages. It has one of the most efficiently managed terminal railway systems in the world. Its competitors complain that it has large advantages in through railway rates. Chicago, for example, asserts that the rates from St. Louis to the Southwest, and also to St. Paul, are too low as compared with those from Chicago. Indianapolis complains that the rates from St. Louis are too low as compared with those from Indianapolis to almost all points of the compass. Galveston complains that the rates from St. Louis to Oklahoma, Kansas, Arkansas, etc., are too low as compared with those from Galveston. The cities on the Pacific coast complain that the rates from St. Louis to the intermountain territory are too low as compared with those from the coast. According to its competitors, St. Louis is one of the most favorably situated cities in respect to freight rates in the United States. Now, the Terminal Railroad Association is owned by the trunk lines that enter St. Louis. Therefore, the trunk lines, which, in effect, have made the rates charged by the Terminal Association, have also made the very favorable rates which St. Louis enjoys to all parts of the country. Does it not appeal to the sense of fairness

of the *Globe-Democrat* that when it discusses the rate adjustment of St. Louis it should consider it as a whole? It is the entire adjustment that affects the city's commerce. The *Globe-Democrat* says that the business men of St. Louis do not propose to "stand" the disadvantages under which, it asserts, they labor. There are other cities which say that they do not propose to stand the disadvantage under which they labor as compared with St. Louis. The jobbers at Denver and on the Missouri river are finding, as a result of their successful litigation about the class rates from the Atlantic seaboard, that rate readjustments are not jug-handle affairs; for they are in a fair way to lose by the Interstate Commerce Commission's principle, that a through rate should ordinarily be the sum of the local rates, two dollars for every dollar that they may gain by it. Probably the disinterested and public-spirited real estate men of St. Louis will never agree that the Terminal Railroad Association should be given the ordinances it needs to develop its facilities. If it should be they would not get a chance to sell as much real estate for railway purposes as they would if all the eastern railways were forced to establish terminals in St. Louis. But we are sure that if the *Globe-Democrat* will give due consideration to all the rate advantages and disadvantages of its city, it will conclude that St. Louis will be very much wiser to bear with such small rate evils, real or imaginary, as it now has, rather than to fly to others of which it knows not.

CANADIAN RECIPROCITY AS AFFECTING NEW ENGLAND.

FREDERIC BASTIOT, the French economist, used to state a principle of political economy somewhat in these words: "All men, women and children are consumers. They must, at the very lowest terms of consumption, eat to live. But all men, women and children are not producers. And only a small part of the producers are such under a system of bounties, direct or indirect, of governments. Therefore, as a very broad generalization, the consumer's interest represents the greater good to the greater number." This postulate which may almost be called an axiom of Bastiot, can by an easy shift be applied to the railway interest thus: Consumption is the larger and more vital interest. It creates demand which production must and will necessarily meet. The gap between the two is spanned by trade, and transportation is a prime factor in trade. Trade must have its common carrier. Therefore any bar of trade is against the carrier's interest.

This general dictum may be specifically applied to a region like New England. The six New England states, constituting together but one small corner of the nation, are, along with their geography, highly concentric. They have a dense population, very largely focused in some eighty cities, not to mention many congested factory towns; and they have one controlling industry, manufacturing, which in a very great degree makes them industrially homogeneous, though within the bounds of manufacturing the products are infinitely heterogeneous. Moreover, most of the New England factories are old; they are the beneficiaries of the latest mechanical devices of the inventive Yankee race; whether it is machine work or hand work they are highly organized; and the cost of labor and cost of material are almost the only varying elements of their efficiency in competition. As related to the railways, the vast factory interests of New England consume low class freight and turn out high rate freight. They take in raw iron, copper, steel, wool and cotton. They send out iron, copper and brass machinery and hardware, large and small, and the manufactured textiles. And they send not merely to the rest of the country but to transatlantic markets. Their business is intensive and assertive, constantly craving an expanded market; and more than ever needing the wider mart, now that, seeking either nearness to the market or to the raw material, the competing cotton factory is springing up in the South and mechanical industries in the Central West.

As New England is geographically and industrially consolidated, so is the system of railways, now almost exclusively under the New Haven company's ownership or control. But the outlying northern part of the New Haven system is represented by the Boston & Maine, whose lines, including those of the leased Maine Central, reach the Grand Trunk and the Canadian Pacific at seven or eight points. Bearing on the character of the Boston & Maine traffic as affected by the proposed reciprocity treaty with Canada, its classification of freight business last year is suggestive:

Commodities.	Tons.
Products of agriculture	2,979,023
Products of animals	1,044,721
Products of mines	5,966,008
Products of forests	3,334,577
Manufactures	4,659,081
Miscellaneous	4,832,118
Total	22,815,528

The detailed analysis of the large groups of railway freight on the connecting system between New England and Canada brings out some striking facts in favor of the reciprocity schedules.

Out of the first group (products of agriculture, 2,979,023 tons) only three, hay, potatoes and vegetables can possibly mean injury to the farmer under the reciprocity plan, and of these hay has the natural vantage of bulky material in nearness to the New England markets; and the great potato crop of Aroostook county, Maine, has the additional vantage of prolific soil and wholesale cultivation by machinery. The three products named are less than one-third of the Boston & Maine "agricultural" freight, the rest—grain, flour, cotton, etc.—coming from outside New England. These exotics, under any tariff, must for the most part enter New England by rail either over the Boston & Albany or by the New Haven system, including the Boston & Maine.

The second group (1,044,721 tons, products of animals) includes live stock, dressed meats, other packing house products, poultry, game, fish, wool, hides and leather. A mere glance at these commodities will show how largely they are extraneous to New England. Fish, with game and poultry, formed together but 66,936 tons; and the protests of Gloucester against reciprocity and free fish is more than countered by the acclaim of reciprocity by the fish merchants; also the census figures show how Gloucester gained 70 per cent. in population under the old Canadian reciprocity treaty and has fallen from 28,211 to 24,398 during the last 15 years.

The third group (products of mines, 5,966,008 tons) consisting of coal, ore and stone, is so obviously unrelated in the main to New England industry as to require no comment, except to call special attention to the benefit of cheaper coal to the railways under the reduced duty on the coal from the mines of the Canadian maritime provinces. Incidentally, attention may be called to the $8,608,066 extended last year for coal by the New Haven-Boston & Maine system for locomotives alone.

The fourth group (products of the forests, 3,334,577 tons) has as its major item lumber, 2,644,853 tons. Is a reduced duty on Canada lumber as against the extending forests of Maine a thing for railway lament?

The fifth and sixth groups, manufactures and miscellaneous, may practically be treated together as factory products, the advantage for which, as a whole, of the expanded Canadian markets admit of no argument adverse to the railways and every argument in their favor. Together they represent 9,491,199 tons, or approximately 42 per cent. of the Boston & Maine freight business, and of far greater percentage in its total freight receipts, owing to higher classification.

In a general summary the returns show that out of the Boston & Maine total freight traffic of 22,815,528 tons, a tonnage, exclusive of lumber, of not more than about 6 per cent. can by any stretch of fancy or fear be affected unfavorably by the new reciprocity bill, and affected, at most, only by a moderate fraction of that tonnage.

The New Haven system in southern New England, with its

dense population, has no such classification of freight business by commodities as has the Boston & Maine. But with some minor variants it would undoubtedly give similar returns. The conclusion is irresistible that the interests of the New England railways, along with the other transportation interests of that region, lie on the side of the reciprocity bill. That conclusion may for the moment be based on the nature of the railway traffic alone. But it does not negative a closing allusion to the values of general enlargement of trade, the stimulus to business of cheaper commodities, the comforts of lower prices of food for the laborer and those multiplied benefits of the many which contrast with the profits of the few.

PREVENTING COLLISIONS BY STATUTE.

THE question of what shall be done to prevent collisions is now squarely before the legislature of Indiana, and it will be interesting to see what the law-makers do with it. None of the bills appear to have been the result of any serious study of the situation. One proposes to give the railway commission discretion to enforce its orders requiring the installation of block signals; and there is a confusing variety of other measures.

Indiana has been more active in this matter than any other state. A law was passed in 1907 making the use of the block system compulsory, but it had numerous defects. No authority was designated to decide what should be accepted as a satisfactory block system; roads of small income were excepted, and electric roads were specifically exempted. The railway commissioners made earnest efforts to have the law enforced in its proper spirit, but the railways blocked the commission's wheels wherever possible. Last autumn there were several bad butting collisions on interurban roads—one on the Fort Wayne & Wabash Valley, killing 41 passengers—and the commission made a special report to the governor, which report is now before the legislature. The interurban roads are in some respects even more dangerous than the steam roads, and the fact that the block system law does not apply to them does not alter this fact.

If there is any virtue in legislation on this subject, here is an opportunity to demonstrate the fact. A beginning has been made (in the passage of the law of 1907) and the thing to do now is to perfect what has been begun. Block signaling, if regulated by law, ought to be under the control of the federal government for the sake of uniformity; but as long as Congress neglects to act, state legislatures have a good right to act. A legislator who imitates the do-nothing policy of Congress only stultifies himself.

There is no denying the difficulty of the problem. The Indiana commission told the governor, in substance, that the trolley roads ought to have the block system, but that they were so poor that the expenditure which would be necessary for its adoption would bankrupt them. The commission, however, weakened its position by not boldly taking a positive stand for "safety first, speed afterward." The commissioners saw that the block system was the thing needed, yet wasted much valuable ammunition in the discussion of partial remedies. They seem to have ignored the plain lesson of experience, that the block system is the only rational remedy for collisions, and that the time interval system, however much it is bolstered up, will still be so faulty as to be immeasurably inferior to the block system. Improvement, without the block system, is not entirely out of the question, but at best there would be many serious dangers still untouched. The perplexing question of what to do when the block system is seen to be necessary and the only alternative is a serious diminution of the speed of trains, while yet there is no money in the treasury to establish the block system, is one for the railway company, primarily; and the commission, on its part, would have done well to stick more closely to the single main point, the safeguarding of the passengers' lives. It is not bound to settle all the railways' troubles.

It is a pity that the commission could not have made a more vigorous report to the legislature. A perfect report does not insure wise legislative action, it is true; but with a ringing declaration of what ought to be done the commissioners could then, with clear consciences, leave the responsibility with the legislature. We have not the space for the whole of the report, but we give below* its main paragraph, in the commissioners' own language. The commission takes a level-headed view of the situation, but leaves too much to the "wisdom" of the legislature. The subject is so involved that it is to be feared that the legislature—like innumerable other legislatures in similar situations in the past—will fail to take effective action. Legislatures are not likely to have much wisdom on block signaling.

And the wisdom of the commissioners is unsatisfactory. Clear-sighted as they are in nearly everything that they say, they leave the subject suspended in the air. The recommendations for better men and better discipline are excellent, are in the right direction, and are needed, but these improvements *will not prevent collisions;* not unless the teaching of many years of past experience is false. That second paragraph of the recommendation to the company is all right for a preliminary order or recommendation, but if it is to truly embody the rightful demands of the people of Indiana (or of any state) it needs to be backed up by a declaration that *the block system and nothing less* will be accepted as a preventive measure. And the legislators cannot be expected to make such a declaration until they have been suitably informed by the commission.

An esteemed correspondent who lives in Indiana has written to inform us that in some of our comments in the past we have done the commissioners a grave injustice by calling them a political commission, and he takes up the cudgels in their defense. He says that there are as many Democrats as Republicans among the commission's employees, and that the commissioners themselves are non-partisan, and in this matter of safety they have done the best that could be done under laws which give the board very limited powers. Assuming that we did use the term here cited—we have not found it in our recent files—we referred not so much to the doings of the board as to its origin. As in nearly every other state, the commissioners, selected by or in accordance with the spirit of a governor and a legislature whose

* "Conclusions as to the cause of these accidents are not difficult; the recommendation of a practical and efficient remedy for such accidents under subsisting conditions of interurban organization, operation and revenues is the most difficult work ever required of this commission. It is clear to us that these operating conditions are incompatible with safety, and we so report; and that fatal accidents must continue to occur unless there are radical changes and betterments: that on the one hand, the public demand, and have the right to demand a much higher degree of safety than these lines now afford, and this proper factor of safety can be secured only by the expenditure of larger amounts of money than is now used in the employment of competent, trained, experienced men, and the installation of adequate safety devices, and by holding to criminal responsibility who ever by flagrant neglect causes these fatalities; on the other hand, it is equally clear that if this is done, as it ought to be, that there will be little or nothing left, passing all questions of dividends on stock, to pay interest on the bonds of some of these companies."

Acting under the law providing for such cases, the commission sent to the Fort Wayne & Wabash Valley Traction Company a list of recommendations for improvements, the substance of which was as follows:

1. (a) That said company shall secure and employ better railroad men for motormen and conductors, taking such steps as are necessary to secure capable and fit men, and to keep them in their service; (b) that applicants for positions as motormen or conductors should not be employed until their former records have been carefully considered; (c) that all motormen hereafter employed shall have at least one year's experience in train service, this qualification being no greater than the law of the state requires for flagmen of passenger trains on steam railways; (d) that no other duties be assigned to motormen than the operation of their cars, and that they shall not be required to do the work, or assist in doing the work of baggagemen or expressmen; (e) that separate compartments shall be provided for motormen, so that their exclusive attention may be given to operating their cars, and so that they may not be diverted by the conversation of passengers or other persons; (f) that when a trailer or an additional car is attached to the motor car, a third man shall be put on to assist and work under the direction of the conductor.

2. That said company proceed to install block signals on its interurban railway, and to this end that within sixty days, it shall report, and submit to this commission plans and blue prints of some adequate block system, the same to be hereafter installed and operated as soon as practically possible.

3. That said company shall enforce the double order system of despatching on its lines; and that hereafter no exception under any circumstances shall be made to this rule. Delays are better than accidents.

4. That although trainmen should operate by rules and time-cards and orders, and signals when installed, said company shall proceed to eliminate obstructions to sight at curves, where sight is badly obstructed. And until this is done, said company is directed to post slow speed signals at said curves, and to reduce speed of cars at such places to a limit of not exceeding fifteen miles per hour.

5. That division superintendents and trainmasters should not be burdened with other duties than those pertaining to train operation.

6. The train despatchers should not be required to handle interlocking plants or to perform other duties than those pertaining to the despatching of trains.

very breath is politics, can hardly be expected to get out of that atmosphere. A bi-partisan commission, impartial as between different parties, is often weakened by politics as much as though it were partisan, and the term "political" would apply to it the same as the other. Even in New York, Governor Hughes, who was looked up to by the whole country as an ideal officer who would act wisely in matters of this kind, in appointing ten commissioners, selected only two who were experts in railway matters. We are free to admit that the Indiana commissioners have done as well as they knew how to do; what we complain of is that they did not take expert advice in regard to the collision disgrace *and do as well as anybody knew how to do*. It is quite possible that the advice which they took was sound, but that they lacked the courage to adopt it, and present a correspondingly vigorous declaration to the legislature. But a situation of that kind only emphasizes our point the more forcibly; for to give sound advice to a legislature a railway commissioner not only must have public spirit and general knowledge, but, in addition to these, that special knowledge of railway conditions which, in many critical matters, comes only from training and experience in close contact with railway conditions. In other words, a railway expert is needed. It is out of the question to expect even the best citizens, non-railroaders, to qualify as capable commissioners in one year; nor in three years, except under favoring circumstances.

THE "LEAGUE FOR PUBLIC SAFETY" AND RAILWAY ACCIDENTS

"LEAGUE for Public Safety" is the name of a concern, having headquarters in Chicago, which is inquired about by a correspondent whose letter we print in another column. This "league" devotes itself principally to the promotion of an automatic train stop; and as schemes for the introduction of one device or another under this general head seem to be increasingly common, we have taken some pains to make inquiry, on the lines suggested by our correspondent. The particular apparatus offered in this case may or may not have merit in itself—some devices possessing a good deal of worth have fallen into the hands of discreditable persons—but as the Chicago concern represents a type of men which has annoyed railway officers throughout the country, it may deserve a word.

Clyde Alison Mann was formerly the secretary of this "league." He tells us that the present secretary is E. P. Bryant. Mr. Mann, however, is still "very much interested" in its work and expects to see the "league" very active during the present year. He admits that he has been active both in the "league" and in the organization of the Railway Safety Equipment Company, but protests that no unfavorable conclusion is warranted from his simultaneous connection with the league and with the automatic stop concern. He says that as soon as he can get the league "on its feet" he intends to withdraw from it and give his services entirely to the Railway Safety Equipment Company. The device being promoted by this company consists of a hinged lever depending from the engine or tender, and a trip which in the stop position presents a curved upper surface to the roller in the lower end of the lever. The upward movement given the roller by its passing over the curved surface of the trip causes a service application of the brakes. The device has not been tested by any railway officers or the engineers of any state commission, so far as can be learned, nor is it included among those schemes that are considered by the Block Signal and Train Control Board to possess merit warranting their further development.

The claim made by the "league" in the circular quoted by our correspondent that the Block Signal Board is overwhelmed with work and can make little headway, has no substance. The board has had to deal with a great many devices which do not deserve consideration; but so far as concerns those which have merit, the board has complained rather of delay on the part of the proprietors. Automatic stops which are worth testing have been tested as fast as they were presented in accordance with the rule laid down by Congress.

The general subject of automatic stops was considered in an editorial in our last issue, page 153. The problems connected with it are beset with difficulties. The theory is attractive, but in its practical application the superintendent and the signal engineer have to deal with refinements of mechanical and electrical practice, and of discipline, which can be only imperfectly measured and compared. Whether to try to improve the safety of trains by the simple methods which have proved so successful in England; or to assume that English discipline is impossible in this country and try to make mechanical devices take the place of men, is a question which two railway managers might decide in opposite ways, and yet neither of the two be able to prove the other wrong. The most common error is the assumption that the mechanical (or electrical) substitute for brains will be perfect. It is almost certain *not* to be perfect.

The problem being thus obscure, the rational-minded inventor or railway manager will handle it constantly with caution. As the Block Signal and Train Control Board has said, there is an unlimited field for the improvement of the personnel as well as the *materiel* of American railways. Muckraking circulars concerning railway accidents almost invariably prove to have their origin in schemes for private profit, rather than in a desire to promote the welfare of the public. With such a purpose, the promoter always aims to get something done by the railway companies, which are supposed to have fat treasuries. If purely disinterested, why not look at some of the faults of the men? Unfortunately, these can be cured only by the slow processes of education, and there can be no patent on any magic formula. The railway companies have sins enough to answer for, and we are not offering apologies for them; but there would be a more even balance in the discussion if the employees were oftener called to account for their delinquencies. It often has been pointed out that a large majority of accidents on American railways is due, not to shortcomings of plant or rules of operation, but to the failure of employees to obey the rules. The railways of Great Britain do not have automatic stops, and very few automatic block signals, yet have records of a high degree of safety. That their accident record is better than that of American railways is mainly due to two elements: the universal use of the space interval, and the fact that British employees implicity obey the rules; and they do this because English trainmen and station men have been so long used strictly to obeying rules and orders that it has become second nature. Moreover, the laws designed to punish men who carelessly or recklessly disregard their duty, are better enforced than here. In spite of the fact that these things are well known to railway men and that they repeatedly have been given publicity, most of the denunciation of American railway accidents, and practically all the legislation regarding them, are directed against the railway corporations, and extremely few of them against the employees. But agitations conducted in this way do not and will not prevent accidents. As the Block Signal Board points out, "nowhere in the world have appliances for safeguarding railway transportation been so highly developed as in this country, notwithstanding which nowhere in the world is there a greater proportionate number of accidents of the kind which such advance in the art should prevent."

What is most desirable is better co-operation between the railway managements and the employees to stop accidents. The Chicago & North Western, through its "safety committees," consisting of both officers and men, is making an effort to secure such co-operation, the results of which will be studied with lively interest by railway officers throughout the country. Unless effective co-operation can be generally brought about, we shall require the sort of discipline on our railways to which the masters of steamships are subjected by the United States government. The other day a locomotive engineman on a railway in Idaho ran past two signals which were set against him, disregarded the frantic hand signals of the trainmen on another train, and ran into their caboose, killing the roadmaster, who happened to be on it. When this sort of thing happens on a railway and the superintendent attempts to administer proper discipline, he is

waited on by protesting committees of employees, who very likely will threaten a strike if the management insists on executing exemplary punishment. On the other hand, if the master of a steamship runs past signals he is likely to have his license summarily taken away. A case in point is that of Captain Alfred Croskey and Fourth Officer Henry J. Allen of the steamship *Northwestern*, which was stranded on San Juan island on the Pacific coast on December 2 last. Although Captain Croskey had been on duty continuously over 16 hours, inspectors of the United States government suspended his license for one year, saying that they were "of the opinion that Captain Croskey was guilty of negligence on this occasion in turning the command of the ship over even temporarily to an officer who is not recognized as a skilful pilot in those waters." They also suspended the license of Fourth Officer Allen for three months, holding that, although he had had no experience in the waters in question, he was not relieved from the responsibility of keeping a good lookout and doing his best to navigate his ship safely, and that his failure to ascertain by taking cross bearings of the lights that his position was dangerous was highly censurable. The conductor and engineman of a train are its master and first officer. They are paid high wages because they plead the weight of their responsibilities. It is to be feared there are many of them, and of other employees, who will never fully live up to their responsibilities until they are dealt with in the same firm way by public sentiment and by the government as are the officers of steamships; and there is precisely the same reason for so dealing with them as there is for so dealing with the officers of steamships.

Before the government will so deal with them, it will be necessary to educate public opinion to a point where it will require the government to do it. How this work of education shall be done is a hard problem. The Harriman Lines began some years ago to carry on the work of public education by giving wide publicity to the facts about their accidents. In the year 1903-1904 the number of accidents on the Union Pacific was 20 for 1,000,000 locomotive miles, and in the last half of 1910 it was but 4 for 1,000,000 locomotive miles. In 1903-1904 there were 29.5 accidents for 1,000,000 locomotive miles on the Pacific system of the Southern Pacific and in the last half of 1910 there were but 10.5. It is certain that this marked reduction in accidents was not brought about entirely by publicity, for meantime the plants and operating methods of the Union Pacific and the Southern Pacific were greatly improved. But it seems quite probable that it was largely brought about by publicity. And it is absolutely certain that the work of public education, which is one of the prerequisites to the substantial reduction of accidents, is not only not furthered, but is to a large extent rendered impossible, by the reckless denunciations of irresponsible writers the sole purpose of some of whom seems to be to get their hands into the railway companies' treasuries.

NEW BOOKS.

Mechanical World Electrical Pocket Book for 1911. Cloth, 3⅞ x 6 in., 180 pages of text and blank pages for diary and memoranda for the year. Price, 6d. Emmott & Company, 20 Bedford street, London.

The electrical pocket book published by the *Mechanical World* of London has been revised and so condensed that it affords space for a large number of new tables relating to current density, temperature rise, illumination, depreciation allowance and many others. The notes on accumulators have been rewritten and extended and a new section on liquid starters has been introduced. In general, the book has been thoroughly revised and contains many new illustrations.

Employers' Liability and Workmen's Compensation. Bureau of Labor, Department of Commerce & Labor, Washington, D. C.

Bulletin No. 90 of the Bureau of Labor is devoted largely to the subjects of employers' liability and workmen's compensation. There is a history of federal and state legislation, and the work of federal and state commissions appointed to inquire into the subject; action taken by employers and associations of employers and workmen, and the laws recently enacted by the state of New York; the results of a recent conference in Chicago of state commissioners; a summary of the important features of workmen's compensation systems at present in force in 26 countries, and the cost of employers' liability and workmen's compensation insurance in the United States and various other countries.

Proceedings of the International Railroad Master Blacksmiths Association. 258 pages, 6 in. x 9 in. Secretary, A. L. Woodworth, C. H. & D. R. R., Lima, Ohio.

The eighteenth annual convention of this association was held at Detroit, Mich., August, 16, 17 and 18, 1910. Among the more important subjects considered were tools and formers; frogs, crossings and switches; treatment of high-speed steel; frame making and repairing; the use of scrap; piecework; oxy-acetylene welding; spring making and repairing. An account of this convention appeared in the *Railway Age Gazette* of September 2, 1910. The book is neatly arranged and contains a large number of illustrations of tools and handy devices. The executive committee met October 23, 1910, and selected Toledo as the place for holding the next convention.

Letters to the Editor.

THE "LEAGUE FOR PUBLIC SAFETY."

To the Editor of the Railway Age Gazette:

For some time railway managers and the press in all parts of the country have been receiving circulars sent out by the "League for Public Safety," 339 Rand-McNally Building, Chicago. The "League" in these circulars has dealt with the subject of railway accidents. It has given statistics about them in gruesome detail, lamented their continuance in many Jeremiads, and criticized railway managements for inadequate appreciation of the needs of the situation. In its bulletin number two hundred forty-six, dated January 14, 1911, for example, it says, "Railway managements fail to realize that the reduction of wreck damage and loss will pay for *protective equipment* in from one to ten years. *Absolute protection* will pay for itself in a few years."

Who are the men who are thus giving their time and spending their money to promote the safety of transportation on our railways? Who is C. A. Mann? It is said that the same office which is occupied by the "League for Public Safety," and from which it sends its literature, is also occupied by the Railway Safety Equipment Company, which recently was organized, under the laws of Illinois. This company was formed to promote the sale of the Collord-Rohe automatic stop, a device intended, as its name implies, to bring trains automatically to a stop when there is danger ahead.

In one of the circulars of the "League" which was sent to numerous general managers of railways it says:

"The Train Control Board of the Interstate Commerce Commission is overwhelmed with devices, good, bad and indifferent, designed to accomplish this purpose (to add the automatic stop feature to block signals), and, consequently, can make little headway. Therefore, the appalling casualty record requires that any practical solution of the Board's chief problem be presented to you as very important to the public and the railways. *We have made independent investigation, and beg to forward herewith for your engineers, data concerning the 'Collord-Rohe' equipment, which tested very successfully. We understand it is inexpensive, simple, absolute, can be used in connection with track circuits or manually and by steam or electric roads. Public welfare, we are convinced, will be served by an investigation of the merits of claims made for the Collord-Rohe patents.*"

Many railway officers would be glad to know what, if any, backing is really possessed by such "leagues" as this. If they are able by their sometimes plausible statements to influence legislators and others, their true character should be known. On the other hand, if they are mere money getters, such as are referred to by the Block Signal Board in its annual report as "scarcely less than fraudulent" (*Railway Age Gazette*, January 20, page 119, bottom of first column), they ought to be exposed. C. W. S.

DEVELOPMENT OF THE WESTERN MARYLAND.

BY GEORGE L. FOWLER.

Associate Editor, *Railway Age Gazette.*

The Western Maryland is building an extension from Cumberland, Md., northwesterly for about 87 miles, across the Allegheny mountains to Connellsville, Pa. The way is hard and rough, yet all pains have been taken in the location and construction of the extension to make it a low grade mountain line fully up to the most modern railway work. It is evident that there must be some very good reasons for such an undertaking, and it is the object of this article to set forth these reasons.

As it stands today, the Western Maryland represents the consolidation of two comparatively small roads with a link that was built to connect them. While it forms a part of east and west and of north and south lines, it is a small part, and is not considered as an element of great moment in through traffic. The two roads forming the basis of its present mileage are the old Western Maryland, running from Baltimore west to Cherry Run, with a loop around by Hanover, having a spur to York and a branch from Edgemont on the main line north to Shippensburg, where there is a connection with the Philadelphia & Reading; also a low grade cut off line from Hagerstown to Zumbro on the line from Edgemont to Shippensburg, making a low grade connection via Hagerstown, with the Philadelphia & Reading at Shippensburg. The second road is the West Virginia Central & Pittsburgh, running from Cumberland southwesterly to Elkins, Durbin and Belington, W. Va., and tapping the coal measures in the northeastern portion of that state When these two roads had been brought under one management there was a gap of about 56 miles between them. The West Virginia Central & Pittsburgh originated a large portion of the coal traffic which after being hauled to Cumberland was there delivered to the Baltimore & Ohio to be taken to Cherry Run, whence it went over the western Maryland to tidewater or was sent north for New York or New England delivery. Under these conditions the originating road had only a partial participation in its own traffic and the first step taken in the development was to build the Cumberland connection from Cherry Run to Cumberland, and thus make a through route from the West Virginia coal fields to tidewater. It was a heavy piece of construction, costing about $117,000 a mile, but the results have justified the outlay.

While a discussion of these West Virginia coal fields belongs more properly to the industrial department of the road, it is well to mention them here because they have heretofore furnished the main body of the road's traffic. The entire coal movement at present is about 7,000,000 tons annually and is growing rapidly. The coal originated on the line comes from the Georges Creek, Potomac and Kanawha fields. The location of these fields is shown on the map.

But a few miles from the Huttonsville terminus the famous New River coal field will be reached. Up to this time its development has been discouraged owing to the enormous quantity of coal available at nearer points to market. A demand for this superior quality of coal is causing attention to be paid to this field and an early development may be expected. An average analysis of the New River coal as mined for local use near Elkins, may be taken as:

Moisture	.35	per cent.
Volatile matter	29.03	" "
Fixed carbon	65.87	" "
Ash	4.75	" "
Sulphur	0.828	" "

from which a coke of the following analysis can be made:

Moisture	.52	per cent.
Volatile matter	.54	" "
Fixed carbon	92.01	" "
Ash	6.93	" "
Sulphur	.52	" "
Phosphorus	.029	" "

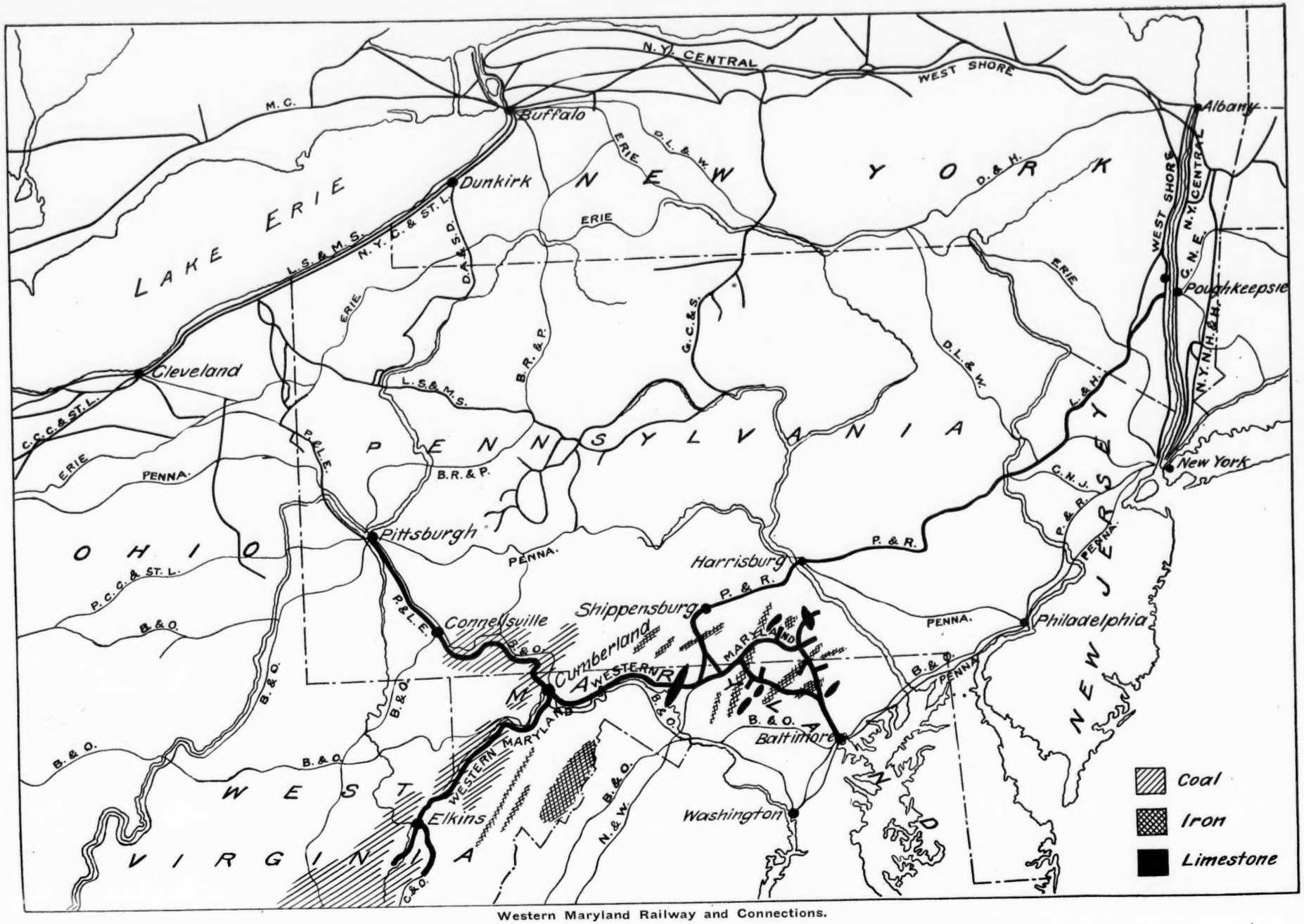
The coals of the Upper Potomac basin run higher in ash and lower in volatile matter. For example those of the Kittanning seam carry from 7.5 to 8 per cent. ash, about 22 per cent. volatile matter and 69 per cent. fixed carbon with about 1 per cent. sulphur and .017 per cent. phosphorus. The Freeport coals present about the same analyses. The Georges Creek coal is nearly worked out and the estimates are that it will be exhausted and the operations abandoned in five or six years more. The Kanawha coals that are on the line have approximately the same analysis as the New River. The veins run from 3 ft. to 6 ft. thick, with occasional rises to as high as 23 ft., the latter being a limited area of the Georges Creek or Pittsburg Dam. But this last is very exceptional and these thick veins are nearly exhausted. But in addition to the fields which are already being worked there are other and adjacent properties that have not yet been tapped and which contain hundreds of millions of tons which the future development of this region will bring to the surface. Among these fields is that of the Freeport and Kittanning measures, lying along the Casselman and Youghiogheny rivers, which has not yet been sufficiently explored to determine its possibilities either in quantity or quality, but of which the indications are that it will be valuable in both. It is known to be a coking coal. It is rather high in volatile matter and ash, and must be washed before shipping, but is, nevertheless, a thoroughly marketable article and is found in seams of from 3 ft. to 7 ft. thick. In the years that it has occupied the Youghiogheny valley, the Baltimore & Ohio has made no attempt to cross the river and secure this product. It involved considerable expense in the way of bridges and spans, so that it has been neglected. The estimated traffic that can be secured from operations to be developed in these fields is placed by the Western Maryland officials at 1,000,000 tons a year, with a probability of 1,000,000,000 tons existing and available with modern methods of mining and prices.

At present the output of the mines controlled by the company is about 12,000 tons a day, to which 6,000 tons must be added for those of the independent operators, with a steady and healthy growth on the part of each, which will insure a good traffic to the road for years to come.

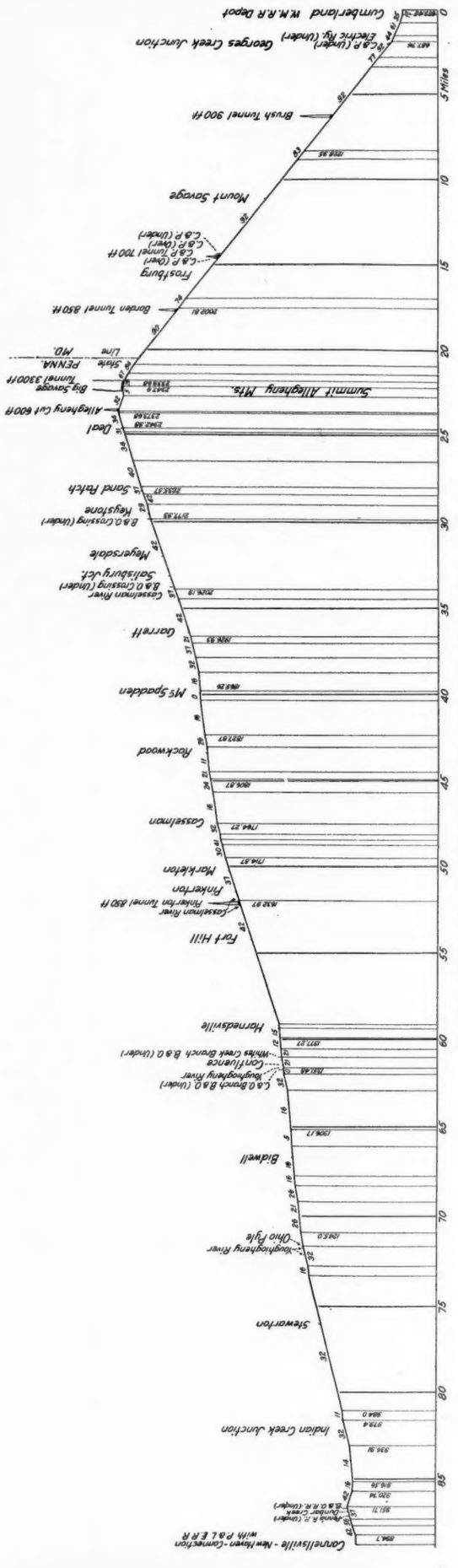
Returning to the development under consideration, even with the Cumberland connection from Cherry Run there was no through connection. It will be remembered that several years ago, it was expected that the Western Maryland would be the eastern outlet of the Wabash. This did not work out, however, and after the reorganization of the company, a year ago, traffic arrangements were made with the New York Central Lines west of Pittsburgh, with the result that, with the Pittsburgh & Lake Erie between Connellsville and Pittsburgh, it only remained to build a line from Cumberland to Connellsville to secure the shortest line between Baltimore and Pittsburgh, and to throw open the rails of the Western Maryland to through East and West traffic, and put it in the position of a competitor for trunk line business.

The details of the construction of this line are of sufficient interest to warrant a separate consideration, and this will be given, from an engineering standpoint, in the next issue of this paper. Suffice it to say, here, that the immediate problem was to build a low-grade line across the Allegheny mountains, through a rough country, and secure a location that would bring operating expenses down to a minimum, and, while not sparing expenses at a cost to this future efficiency, make a line that would put the minimum burden of fixed charges on the road. The estimated cost was put at about $13,000,000. Contrary to the usual method of financing it was found to be possible to secure the funds and build the line on the proceeds of stock only, so that, when built, it will stand clear of indebtedness and not add a cent to fixed charges.

This tells a double story. It speaks for the skill and standing of the men who negotiated it and for the confidence of investors in the desirability of the connection and of its probable value to the road. As it stands, then, the total funded debt of the main and leased lines imposes a fixed annual interest charge of about $1,275,000. Under present conditions the total gross



Western Maryland Railway and Connections.



annual revenue is about $7,500,000, and it is estimated that this annual revenue will rise to $12,000,000 after the connection is opened for traffic, and that, to repeat, without an increase of fixed charges.

Now, what is the warrant for such an estimate? First, distance. The route over the Western Maryland and the Pittsburgh & Lake Erie to Pittsburgh offers the following advantages as compared with competitive routes:

Baltimore	to	Pittsburgh	via	Western Maryland.....	317 miles
"	"	"	"	Pennsylvania	329 "
"	"	"	"	Baltimore & Ohio.....	327 "
"	"	Cleveland	"	Western Maryland.....	449 "
"	"	"	"	Pennsylvania	468 "
"	"	"	"	Baltimore & Ohio.....	497 "
"	"	Toledo	"	Western Maryland.....	562 "
"	"	"	"	Pennsylvania	589 "
"	"	"	"	Baltimore & Ohio.....	642 "
"	"	Chicago	"	Western Maryland.....	806 "
"	"	"	"	Pennsylvania	798 "
"	"	"	"	Baltimore & Ohio.....	813 "

The distance from Pittsburgh and Chicago to New York will also be less by this new route than by the Baltimore & Ohio. It is argued, then, that with a lower mileage the chances for traffic are at least as good as over competitive lines.

Of course, without suitable traffic arrangements, the extension of the road across the Alleghenies and down into Connellsville would mean little more than a bid for some of the traffic that originates in the great coke district. But, as a matter of fact, it is not this that is sought for, it is considered that this will probably continue to follow its present routes, and that reliance must be placed on getting access to the great Pittsburgh district which the New York Central terminal facilities will enable it to do. The Pittsburgh connection will throw open the whole field tapped by these northern and western connections, and it will depend, to a large extent, on the facilities offered by the tidewater terminals as to how much can be induced to move that way. Meanwhile an outlet to the West will be formed for the high grade West Virginia coals that will furnish an increasing amount of originating traffic when the line is in operation.

The new extension, therefore, will not only open a short line to the seaboard, but one that will have ample terminal facilities at each end, and present the minimum of adverse grade to eastbound traffic. As it stands, the profile of the Cumberland-Connellsville extension is the easiest against eastbound traffic of any of the northern lines crossing the Alleghenies. It presents a smooth, almost uniform rise from Connellsville to the summit of the Alleghenies, as well as on the drop down the eastern slope. The maximum grade against eastbound traffic will be 42 ft. to the mile, while that of the Pennsylvania is 79 ft., and the Baltimore & Ohio 53 to 62 ft. This will involve some pusher service, to be sure, which will be discussed in a later issue.

After leaving Cumberland, eastbound, the line runs over an undulating profile, on which the maximum grade against eastbound traffic is 0.3 per cent. for 74 miles to Williamsport, Md. From here it rises on a 1 per cent. grade into Hagerstown (about six miles) and then for 17 miles, to the summit, the rise is by undulating profile, the maximum grades being 1.5 per cent. On this part of the line the Mallet compound locomotive has been introduced for pusher service, with very satisfactory and economical results; one Mallet, with 320,000 lbs. on the driving wheels taking the place of two consolidation locomotives each having 180,000 lbs. on the driving wheels. At Highfield the road divides, one part reaching Emory Grove, 20 miles out of Baltimore, by way of Gettysburg and Hanover, and the other by the more direct southern route. By the latter the distance to Emory Grove is 50 miles, whereas it is 74 miles by the northern route. But as the grades against eastbound traffic are less, on the northern route all of the loaded trains are sent that way, while the empties are hauled back over the shorter line. This affords the facilities of a double track over this portion of the route, an operation similar in every respect to that of the Norfolk & Western from Naugatuck to Kenova, as described in the *Railroad Gazette* of October 2, 1903.

Aside from the through line traffic that is expected from the

western connections, the road runs through a country that is comparatively rich in mineral resources and capable of contributing a considerable originating traffic.

For the first 20 miles out of Baltimore it passes through a rich agricultural section which is being developed along the lines of its natural resources as well as for suburban residence. This section passed, it strikes through a limestone region where the rocks possess valuable properties both for cement making and for furnace flux; and closely associated with these are extensive beds of brown hematite iron ore that have been worked in the past and which probably have a future before them, as they are available and have been used in open hearth work, but which are rather too high in phosphorus to be suitable for the bessemer process. These beds of ore lie not only along the east slope of the Blue Ridge, but extend well down towards Baltimore.

Analysis shows that these ores run from 46 to 48 per cent. of iron, with occasional rises to 55 and even 60 per cent., and that they carry from .67 to .94 per cent. of phosphorus and about .025 of sulphur. Then along the summit of the Blue Ridge there is a line of magnetic ore that has been worked.

These resources are cited, not because it is the expectation of the officers of the road that they will be opened in the near future, but merely to indicate the geologic character of the country through which it passes.

The limestone, however, is a different proposition, and the quarries of that material are being vigorously worked. Analysis shows it to be of a high quality; for example, that at Thomasville shows

Carbonate of lime, $Ca\ Co_3$	97.5	to	98.	per cent.
Silica, $Si\ O_2$	.25	"	.01	"
Iron oxide, $Fe_2\ O_3$	.02	"	.03	"

This is, to be sure, a banner quarry, but the quarry at Wakefield gives from 91.54 to 96 per cent. carbonate of lime, and that at Union Bridge from 94.1 to 97.14 per cent. At the latter place, nature seems to have done her best, for close beside the limestone there are shales especially well suited for cement manufacture, and a mill to utilize the two resources, thus lying together, is in course of construction. At Cotoctin there is a bed of high-grade dolomite that will analyze about 54 per cent. carbonate of lime and from 42 to 48 per cent. carbonate of magnesia. These beds of limestone and ore are also shown on the map.

Further to the west, in the neighborhood of Cumberland, the road passes through a rich and fertile fruit district from which great developments are expected within the next few years.

The situation may, therefore, be summed up as follows: The Western Maryland at present forms a short link in a route from New England to the south by way of the Poughkeepsie bridge and the Philadelphia & Reading, between which and the Norfolk & Western and Chesapeake & Ohio it forms a connection. Of itself it runs from Baltimore to York, Shippensburg and Cumberland, and thence down to Elkins and Durban in West Virginia. It traverses a territory rich in minerals and natural resources, but not yet fully developed, and originates the greater part of its traffic at the present time. On its western extension, running southwest from Cumberland, in addition to reaching the New River coals it taps a lumber district that will cut, in places, 100,000 ft. to the acre, and from which it obtains an extensive traffic. So much for its present resources.

Connellsville is an important originating and shipping point, but is not sufficiently so to warrant the construction of a line through a rather rough country to secure a share of that originating traffic, especially as it must parallel another trunk line for nearly the whole distance in order to get it. We, therefore, come to the real reason for the construction of the extension, which is to make it a connecting link between this eastern road and western connections, so that the combination may add another to the east and west trunk lines. That it will succeed, and will be able to contribute its share to the traffic that will follow, as an originating road, is evidently an opinion held by those who financed the undertaking.

TWO STUDIES OF RAILWAY CAPITALIZATION.

Frank Trumbull's discussion before the Hadley Commission has been revised and printed, as has also a comprehensive letter to the commission written by W. H. Williams, of the Delaware & Hudson. Both discussions naturally deserve the closest study as the expressions of opinion of experts, but this conventional expression is very far from conveying any adequate idea of the breadth and frank intimacy of the two papers. There are certain striking points brought out in the two discussions that make it possible to discuss them aside from a critical review of the whole discussion.

In the first place, there are definitions of capitalization in the two papers that are so searching, and so far from the usual loose definitions that one hears, that any one who is going to make a study of the subject of railway capitalization should at least have them clearly in mind. Mr. Trumbull says: "The technical definition of capitalization applies to the debit side of the account as well as to the credit side; that is to say, property may be capitalized by adding it to assets, even though no capital liabilities be incurred for it; but people ordinarily understand the word 'capitalization' to mean 'to issue capital for either bonds or stock.'" Mr. Williams said: "Stated in another way, the book assets (or capitalization) of a corporation represent capital; the liabilities (including securities) denote ownership and relative equities of the several classes of owners." Readers of the *Railway Age Gazette* may remember that Professor Ripley, in a series of articles on Railway Capitalization in these columns, made a distinction between capital and capitalization. He used the word "capital" to designate the assets, and "capitalization" to designate the liabilities—in this case securities. It will be noted that neither Mr. Williams nor Mr. Trumbull agrees with this distinction. Taking capital to be synonymous with capitalization and to mean book value of the property, both Mr. Trumbull and Mr. Williams discussed the relation of capitalization to rates; and, in company with those who have made the most careful studies of the subject, come to the conclusion that the effect of capitalization on particular rates is nil, and both Mr. Trumbull and Mr. Williams come to the conclusion that as a matter of fact the total capitalization of all railways in the country bears no relation to the aggregate freight rates. Mr. Trumbull's argument is possibly less dogmatic—certainly less sweeping; but both arguments are based on a thorough knowledge and experience of the method by which railway enterprises are financed.

Mr. Trumbull gives the following striking illustration of inverting the income account of the Chesapeake & Ohio for the fiscal year ended June 30, 1910. Instead of deducting operating charges first, he sets up, first:

The interest on the debt, which was for the year	$5,570 000
Dividends of 4¼ per cent. were paid on the capital stock	2,669,000
So that security holders received, as compensation for what he calls "readiness to serve the public,"	8,239,000
Gross revenue was	32,398,000
Setting aside first the	8,239,000
just mentioned, which it seems the operating company is entitled to for "readiness to serve," the company has	24,159,000
With which to pay operating charges of	20,538,000
Leaving the profit on the service at, which is equivalent to 5.77 per cent. earned, but not paid, on the stock.	3,621,000

Mr. Trumbull's argument is that, as a whole, the railways are entitled to a minimum of 6 per cent. for *readiness to serve the public;* that is, readiness to serve instantly 92 millions of people; and that they should earn twice that in order to afford a margin of security for investors against periodical depressions and panics. An analysis of the capitalization and net earnings of all the railways in the country, as reported to the Interstate Commerce Commission, show, of course, that the railways have never anywhere near earned this rate of return; but, as Mr. Trumbull says: "Notwithstanding all of these illustrations, there is a certain demand that for the railways of this country we shall set a stake somewhere and that from that time on there shall be no

"watered" stock. There are naturally some practical difficulties. For example, I believe in some states there is provision that the debt of a railway company shall not exceed its capital stock, and if there should be a prohibition of the sale of capital stock at less than par some companies would doubtless be perplexed. Again, there should be no question about the right of holders of convertible bonds, if they have purchased them heretofore at less than par, to exchange them for stock at par. If every share of stock purchased hereafter must represent one hundred dollars in money or property, I think it not probable that any important new development could be accomplished by independent enterprise. We might do away with watered stock and have in place of it 'arid' stock, and arid stock might not 'make the desert rejoice and blossom as the rose.' For anyone who has actually been engaged in business knows that the simple placing of a dollar of actual value behind each dollar of certificate does not necessarily make a *profitable* investment. The mere act of exchanging one hundred one-dollar bills for a hundred-dollar bill, although a transaction of unblemished integrity, is not in itself exhilarating. Allowance must be made for virgin territory, for all the vicissitudes of business and for human nature, and if an investor thinks that he will get a smaller average return of income *and profit* from railway investment than from other things, he will inevitably discriminate against railway stocks. Money, like its human owners, will go where it has the best prospective reward, and the most liberty. And in this connection it is difficult to see how private capital can be kept interested in railway stocks if it can make more in agriculture or mining or manufacturing or merchandising."

Mr. Williams has two quite separate arguments to prove his point. Taking first the simpler and less far reaching argument, he expresses the opinion that the business of railways may properly be divided in two quite distinct categories: one, the ownership of a public highway or turnpike and the optional furnishing of vehicles for the transportation of goods and passengers; and the other quite distinct business of actual transportation of goods and passengers over this semi-public highway. He says: "In other words, the owner of the turnpike is entitled to not less than the legal interest on the value thereof, and at the same time the hackman taking passengers over the turnpike is entitled to a reasonable reward for the services rendered by him, and this reward will depend on efficiency, and that return is never limited to the amount of his expenses plus a fair daily wage." Taking Interstate Commerce Commission figures, Mr. Williams shows that net earnings failed to equal 6 per cent. on the cost of the property by over $176,000,000, for 1908, for instance, leaving, consequently, nothing whatever to pay for service rendered.

As a matter of fact, Mr. Williams' arguments would appear to make this discussion of purely academic interest. All these questions are more or less dependent on the determination of the relation, if any, existing between:

1. The cost price of material in place.
2 The par value of securities issued and outstanding, and
3. The present value (sometimes called "fair value") of the property.

After showing that the cost of the property to the present owners has little, if anything, to do with the original cost of the rails, labor, equipment, etc., because in nearly every case of existing railway companies, except a few of the smaller ones, the present railway company's outstanding securities represent reorganizations following receiverships, or, to a large extent, the purchases of properties of other companies and the subsequent merger or consolidation with the purchasing company. In view of these facts it is plain that there is no fixed necessary or common relation between the "cost of material in place" and the "cost of the property to the present holders thereof."

"The aggregate par value of securities is controlled by (a) the 'cost of the property to the present holders thereof,' and (b) by the rate at which they will be accepted in payment therefor by the sellers, or at which they can be sold for the cash needed to pay the purchase price. It may be concluded, therefore, that there is not, nor can there be, any definite and fixed relation between any two of the three items.

"Property without the right of use has no value. Value begins with use and increases as use increases. It is dependent upon the *right* of use, and is controlled by the *extent* of use. The value of a railway, therefore, is not constant, and may be subject to frequent and to violent fluctuations.

"The present value of the property is its value in use, and so cannot be fixed by the aggregate par value of securities issued and outstanding, or by the original cost of material in place, nor would the fact be otherwise were stock and bonds to be issued at par (with neither a discount nor a premium) and were all additions and betterments and all extensions paid for by the issue at par of capital securities. The part value of securities issued is the consequence of past transactions and so cannot be controlled by so temporary and fluctuating a fact as 'present value,' but these transactions are too remote from original cost to have been controlled thereby and 'the cost price of material in place,' being antecedent to both of the other facts, could, of course, be controlled by neither. The suggestion that value in use can be increased or diminished by issuing or declining to issue new securities in any amount needs only to be stated in order that its absurdity shall be recognized."

As we understand Mr. Williams' argument, the money value of the material, labor, equipment, etc., that is originally put into the building of a railway is the building company's guess at the value of that railway. If the value in use does not approximate the original guess as to its value, the company will go through a reorganization in which securities will be issued not against the original cost, but against the revised *guess* as to the value of the railway, and it would be as absurd to say the guess affected the value—that is, the earning power—and ability to charge high or low rates, etc., as to say that a man's guess as to whether a coin was placed heads up or down would in any way affect the coin itself.

It might be argued that if the total amount of securities issued, with the consequent interest requirements, cannot affect rates, why then should an increase in the operating expenses change economic conditions so that roads can charge higher freight rates? The answer to this argument is that, first, the amount of capitalization of each railway was the guess of a different set of men, and these guesses, like bids for an issue of bonds, are competitive guesses, so that if a mistake is made in one case it may be to the direct advantage of some other company; in other words, if a man, or company of men, built a railway through a territory which cannot support that railway, either owing to competitive conditions or to lack of traffic, they are the ones who have to suffer, and the burden is not shared by a company owning a railway in an entirely different part of the country. On the other hand, an increase in operating expenses extends over the whole country. It may not affect different roads to an equal amount, but it affects all; it is as if the government owned all the railways and should decide that they were all to perform some extra service which would raise the cost of operating railways, which would raise the cost to either the traveling public or the tax payer, and this higher cost would become effective automatically. A general increase in operating expenses does not bring with it quite automatically an opportunity to earn more, but the railway's contention is that this adjustment must eventually take place. Fixed charges and wages to labor are both expenses, but the fixed charges are controlled by competitive conditions as among the railways themselves, while a change in the cost of labor effects all the railways and is conditioned by something entirely outside.

In a Government Loan Bill, recently passed in Victoria, Australia, for the construction of new railways, a proviso is inserted, giving a minimum wage of $2 a day to all men engaged in railway construction.

STUDIES IN RAILWAY ECONOMICS.

BY W. M. ACWORTH.

V.

At this stage I desire to interpolate one remark. The arguments of the foregoing articles have been addressed to the ordinary plain man, who has no prepossessions for or against state ownership in the abstract, who regards the question of state or private ownership as a practical question, to be decided one way or another on the facts and evidence. To those who on abstract grounds believe in the socialization of all the means of production and distribution as the only fit scheme for the governance of the universe I have nothing to say. I am not writing, nor am I competent to write, a treatise on socialism.

To proceed: it may be noted that so far we have only considered the question from the point of view of the public, regarded as a whole. Now, the interests of the public and of the individuals composing it are by no means identical. It may well be in the interest of the whole community—I do not discuss whether it is—that the railways should carry agricultural produce at a loss, in order to keep agriculture, the backbone of the nation's strength, in a prosperous condition. But it is certainly not in the interest of the community that the railways should carry Messrs. A. B.'s manufactures at a loss in order to increase Messrs. A. B.'s profit from $100,000 to $150,000 per annum. Yet we can hardly blame Messrs. A. B. if this point is not as transparently clear to them as to others. In fact the classic instance of the Berwick fish merchants, who wrote to the board of trade during the rates inquiry in 1889: "What we want is to have our fish carried at half present rates; we do not care a ——— whether it pays the railway or not," is, except perhaps in strength of language, quite fairly typical of the attitude of the average trader where his own business interests are involved. And, further—for the average man is, in spite of the common belief to the contrary, anything but a reasoning animal—I do not doubt that the demand of the Berwick fish merchant had at least the tacit sympathy of the Berwick grocer and the Berwick butcher, even though it is perfectly obvious that the fish merchant's demand was anti-social, and that, if he got his rates down regardless of whether it paid the railway company or not, the rates charged to the grocer and the butcher would at least have tended to go up. I am not speaking the language of paradox, but of sober conviction when I say that, though of course low rates as a whole are in the public interest, the demands of particular trades and particular localities—still more, of course, of particular individuals or firms—for specially reduced rates are quite likely to be as much against the interest of the public as against the interest of the railway.

On the other hand, though I believe particular and sectional demands are very often such as should not be conceded, even apart from consideration of the pecuniary sacrifice to the railway involved, there must be cases, few in percentage of the whole, but large in aggregate number, which have justice on their side. And it is evident that, having regard to the relative size of a normal railway and a normal private undertaking and the impersonal organization and inaccessibility of the actual railway management, the trader may fail to receive the well-weighed and even-handed justice that he is entitled to expect; or, what is even more important, may not believe that he has received it even when the facts are otherwise.

The trader is entitled to claim at the hands of the railway company, *positively*, (a), reasonable rates, and (b) reasonable facilities, and, *negatively*, that none of his competitors shall be given undue preference over him. This sounds simple enough. The difficulty begins when we start to decide what is a reasonable rate, what is a reasonable facility, and what is undue preference. Let me set up to be shot at my own definition of a reasonable rate: "A reasonable rate is a rate which an expert manager would fix, or, as the case may be, would maintain, having carefully considered all the relevant circumstances, and being actuated solely by judicial and avowable motives." The definition needs explanation and justification. In the first place, it is clear that it may be reasonable to maintain a rate already in existence where it would not be reasonable to introduce it *de novo*. To deprive a man of something that he has long possessed is a much greater hardship to him than it is to another man to refuse him something which he has never had. In other words, one of the relevant circumstances which the manager ought to take into careful consideration is "the acquired situation." How much importance he ought to attach to it is a matter of judgment, having regard to all the circumstances of the acquired situation. Further, there are two parties to the rate, the railway that receives, and the trader who pays; and a rate to be reasonable requires to be reasonable from the point of view of the railway which receives just as much as from that of the trader who pays. One would have thought that to state this was only to enunciate a truism, were it not that experience shows the contrary. I remember twenty years ago the leading counsel for the traders in the board of trade inquiry as to maximum rates laying down as a self-evident proposition that a rate which stops the traffic cannot be a reasonable rate. And within the last few months an American authority, writing not as attacking, but in defence of the railways, made this admission in the columns of the *Railway Age Gazette*. And yet any such position is absolutely untenable. It is surely obvious that the nearer the rate approaches zero, the greater will be the volume of the traffic carried. It is nothing but the railway rate that prevents coal from Scranton or Pittsburgh being sold in San Francisco. But will anyone say that its sale is stopped by unreasonably high rates? If the highest rate that the trader can afford to pay is still lower than the lowest rate the railway can afford to take, traffic is impossible; and either no rate is quoted at all, or, if nominally entered in the tariff, it remains a mere paper rate. I think, therefore, we can fix as a minimum point below which a rate ceases to be reasonable, the point at which the out-of-pocket expenses of operation exceed the total receipts from the traffic.

But this minimum to the railway will, as has been said, be above the maximum that the customer can pay in every case where it exceeds the difference between the production price at the point of origin of the commodity to be transported, and its selling price at the point of destination. It is true that not long since an English millionaire bought a field of old pasture and transported the soil in train loads to improve his garden fifty miles off; but the transaction was hardly of a commercial nature, and is not typical. It is between what I may call respectively the railway minimum and the traders' maximum that business is to be done, and that reasonable rates have to be fixed on every commodity, varying from coal and iron ore on which the quantum of the rate is all important, to articles such as ostrich feathers, where the highest rate that anybody ever in practice charged, or thought of charging, is so trifling in relation to the value of the article that it makes no impression on the selling price. It is, I think, a convenient phrase to describe that portion of the total potential traffic that lies between the two above mentioned points as *viable* traffic. As to how the rates on this traffic are to be so fixed as to be reasonable I have little to add to what I have already said elsewhere. But we may just note that the railway minimum is not a fixed quantity, but varies according to the nature and circumstances and conditions of the traffic in each case. A ton-mile rate, amply reasonable for coal from Pittsburgh to the seaboard, would leave the railway badly out of pocket, if applied to miscellaneous consignments for short distances of high class freight. But assuming the manager to have ascertained, with such accuracy as he can, the out of pocket* cost to him of doing each class of business, and to have supplemented his positive facts with the best estimate his expert skill enables him to make, one portion of the reasonable rate chargeable on each class of business has been accounted for. But out of pocket costs are only a minor part of the total expenses of running the railway. The general expenses of the undertaking,

*See Note at end of Article.

the government and local taxes, the interest and dividend on the capital involved, all have to be provided; and reasonable rates are such rates as, on the one hand, are fairly adjusted *inter se,* and, on the other hand, are sufficient among them to supply the income needed for these latter purposes. A fair adjustment means, in other words, an adjustment on the basis of "what the traffic can bear," a phrase I do not discuss, because I have already discussed it at great length elsewhere.*

But one point more must be added. There is no fixed or abstract standard of reasonableness; the thing is merely a matter of comparison. When a man says that a rate is unreasonably high, he merely means that it is higher than other rates that he believes to be fairly comparable. The same man who declares that a penny a mile is an unreasonably high rate per ton mile for the railway carriage of coal, would be ready to admit that a sixpence a mile was reasonably low for cartage. And circumstances are so infinitely diverse that it is possible for disinterested experts, and still more for interested non-experts, to argue indefinitely whether the comparisons are fairly made, having regard to all the circumstances and conditions. So we come back to the position that the best man to fix a reasonable rate is the most expert, the most knowledgable, and most judicially minded person available. In other words, not an outsider, but an ideal railway manager.

Just one word should be said on the last clause of the definition, "A reasonable rate is a rate fixed by an expert manager—actuated solely by judicial and avowable motives." I have already given reasons for considering that the manager is naturally in a position of a judicial kind—that his tendency is to act as an impartial arbitrator between conflicting interests. Human nature, being what it is, we may expect each trader to desire that he himself shall pay somewhat less than his fair share of the total expenses of the railways, and therefore, that the converging pressure will keep the railway manager in a condition of stable equilibrium. Moreover, the manager's interest from the railway point of view is to stimulate traffic, and if he charges any class of traffic a rate beyond that which it can reasonably afford to pay he discourages traffic. Of course, there have been in the past, and will be in the future, managers who act from dishonest and unavowable motives. That is only to say that it is human to err. Whether the private manager, who concedes an unreasonably low rate to a manufacturing company, of which he is a shareholder, in order to fill his own pockets, is more or less dishonest than a minister of railways, who gives a similar concession to the trade of a town or district, in order to secure its support in a hotly contested election, is a matter we need not here discuss.†

*Elements of Railway Economics, Chapters VIII and IX.

†An English minister not long since annonunced in the constituency that he was contesting a large reduction of duty on an article in which the constituency was largely and directly interested. His opponents said, and no doubt believed, that the announcement had helped, and was made for the purpose of helping the minister's election prospects.

NOTE.—"Out of pocket cost" is, of course, not a precise, but an indefinite phrase. It may mean the cost of carrying the average ton, which is possibly quite high. It may mean the cost of carrying the extra ton, which is probably so small as to be negligible. In practice it is probably used to mean something between the two extremes, tending towards the lower limit in cases where it is desirable to encourage new traffic capable of great expansion.

There is another reason why "out of pocket cost" is an indefinite phrase, in the fact that the cost varies with the volume of the traffic, and the volume of the traffic depends on the rate. A figure for "out of pocket cost," accurate on the assumption that the volume of traffic was x, would clearly be wrong, if the volume turned out to be 4x, or x/2.

"Interest and dividend" is also an indeterminate phrase. In the case of state railways, for instance, Australia professes to take as the proper standard such a sum as covers, but no more than covers, the actual interest on railway loans, with no allowance, on the one hand, for recoupment of the accumulated deficit of early years, or, on the other hand, for a sinking fund to provide for the future. Prussia takes as a standard, not professedly but in fact, the largest sum that can—without raising too pronounced an opposition—be extracted from the pockets of the railway customers in relief of the general taxation of the state. Again, on private railways it is evident that the standard must vary according to the status of the undertaking. Investors in the common stock of an old established and prosperous railway can hardly claim as high a return as would be reasonable for those who put their money into a pioneer line which may never pay a dividend at all, and certainly will not do so at the outset. But then, again, if the old established company has made it a policy over a series of years to keep down dividends and improve its property out of revenue, a dividend of 6 per cent. on the normal capital may really only be a dividend of 3 per cent. on the actual capital put into the road by the shareholders.

THE SUPPLY DEPARTMENT.‡

BY H. C. PEARCE.
General Storekeeper, Southern Pacific Company.

V.

ASSEMBLING, MARKING AND LOADING.

Assembling of Material.

This is undoubtedly the hardest and most important matter with which our supply departments have to deal. There are so many things entering into it that it is hard to lay down any iron clad or fixed rules, but it is recognized as being necessary to have material for a job all go at once. Instead it is the rule to ship everything just as soon as you have it. There are many reasons for this. First, under the theory that it saves handling, etc., a great deal of material for a job is ordered directly, which may come at any time and all times. Second, if it comes through the store, the storekeeper is anxious to reduce his stock, he wants to load it out and get rid of it, and get credit for it. Third, it is the easiest way to handle it, and everybody wants to do everything the easiest way.

The result at the other end is different. A man is going to start a building. The first thing he will probably receive is the shingles, a latch or lock. By the time he gets his foundation material and lumber, the hardware is stolen or used somewhere else. When he gets the building pretty well along, and everything ready, he will find he has not his doors or windows, and he will probably have to shut down the job and move his gangs to another point. Another feature—the material comes dribbling along; first there will be a car of cement, a car of brick, and then a car of rough lumber, some hardware, plumbing, etc. Then he will have to send a gang of men a considerable distance to unload it and take care of it. This is another feature of direct shipments which is always overlooked when being discussed, and one of the reasons why it is not practical to make direct shipments, even of lumber, generally speaking.

So that the proposition which confronts a supply organization is to move material for a job altogether. In order to do that you have to assemble it at certain points, usually at the materials yards. The most practical plan the writer has found, and one which is working out fairly well, is—first, the makers of the requisitions must state on them if they desire any part of the material shipped before it is all complete. All other requisitions will be construed as meaning that nothing is to be shipped until everything else is ready, the reason for this being that invariably when a requisition is made, and before it has time to get the necessary approvals, to say nothing of assembling and shipping the material, the makers commence telephoning to ship this, that and the other thing, and in this way by getting a part of the material on hand they use it as a lever to force greater efforts for delivery of the balance by claiming that the men are on the ground, the loss in time, etc. This, of course, is not right, and is a false position, and it is the first thing that has to be stopped, for there is no excuse for men being sent to a job until the material is there or they have knowledge that it will be there by the time the men are.

So unless a requisition comes in with a notation for some particular item or items that are to be shipped on a given date, it will be held until it is all ready. The storekeeper, on receiving this requisition, will check it up, as described above, lay aside and mark such material as he has on hand to apply upon it, making provision for the balance to be assembled in the same way, and when it is all received and ready for shipment he will notify the maker of the requisition that the material is loaded, giving the numbers of the cars and will go forward on a certain train. Or, in the absence of any such notice, the shipping notice itself will be notice to the maker of the requisition that the material on his requisition for such and such work is on the way and is complete. It is then for him to have the necessary men there to receive it, take care of it, and then go on with the

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work. Of course, there are many details that enter into this transaction that do not make it easy. For example, it is frequently desirable to furnish the foundation material and the rough lumber. Then we should follow along with the mill work, finishing up with the hardware, plumbing, etc. This should be done in the case of large work. The storekeeper will simply have to keep in touch with the job and keep the material going to the work as needed, but for all small work the plan can be carried out intact, as above.

In order to do this, however, it is necessary to have a well equipped and arranged yard, plenty of room for assembling, and if possible such distributing yards should be located close to the industries and shops, so that the shop work can be assembled. This is generally the class of work which causes the most delay and trouble, but supply departments will do well to concentrate their efforts toward organizing along these general lines with this general purpose in view, but they can never do it so long as the idea of direct shipments, low cost and low stock is considered the unit of efficiency.

Marking and Loading.

The greatest care must be exercised in marking and loading material. There is no reason why a railway store should not load and mark its material as well as any first-class manufacturing or jobbing house, and a good organization will do it. In addition to careful packing and marking the address, the requisition number must always be noted, and the date of shipment. The reason for this is to enable the storekeeper and inspectors to tell, when material is found out on the line, the date it was actually shipped there. This has been found by practice to be useful, and leads to much good. This is particularly applicable to frogs and track material where the marking is put on with white lead.

The arranging of freight in cars for transfer to division stores is a very important matter, and by being handled properly can very greatly decrease the cost of doing work. For example, bolts of different sizes should always be separated. If they are loaded in barrels, throw in a few sheets of paper between each size. Pipe fittings the same way, in fact everything should be marked in the car, even though it be a carload for one point, so that the receiver of the material can take it out and put it in his racks or shelves in the least possible time. The material can be arranged in this way in cars just as quickly as it can a wrong way. By furnishing an advice of shipment which will reach the consignee before the material does, the man receiving has a guide to what is in the car, and the material is in order to check and put away.

The full importance of loading, marking and invoicing material from railway stores has never been appreciated, and has in the past caused much criticism, investigation, and needless delay as well as expense. Here is where the organization of the general store comes in. It is the pivot around which all other operations revolve, and without it no thorough or economical store system can be maintained.

Probably more freight is lost by imperfect marking and description than in any other way. Not only should the package be carefully marked with the address and requisition number, but wherever possible the material itself should be marked. For example the frogs should have the angle and weight of section marked on them, as well as the party to whom it is consigned. All other material of the same character should be treated in the same way.

MANUFACTURING, REPAIR WORK AND SHOP DELIVERIES.

Industries and Shop Work.

Probably no more important aid to the supply department could be given than to have such manufacturing industries as the planing, rolling mills, and foundries in charge of and under the direction of the general storekeeper, and why should not this be done? He of all officers is most interested, because he is the man who is looked to for furnishing material, and the full effectiveness, economy and usefulness of these industries cannot be obtained unless it is understood they are the manufacturing plants for the railway and not for any particular individual or department. He is in position to know how much to make, and how much not to make. The idea of making up a lot of stuff just because it can be done cheap, and for the purpose of keeping the men at work is a ridiculous and vicious policy, yet it is one that has always been offered as an excuse for making up material that is not wanted, and in many cases it has been considered a satisfactory explanation. The real economy of manufacturing by railways is the fact that they are able to get just what they want when they want it, and not be obliged to keep a lot of stuff they do not need. In no other way can the general storekeeper carry out the policy of providing material when it is wanted, and assembling it, unless he has absolute control of the industries which are furnishing it. He is the one who should say what work shall have preference.

Of course, in our railway shops where a great deal of our work is done, repair made, etc., it is done in connection with maintenance of equipment, and on store orders from the storekeeper. This is all right, but it must be understood that this work must be done with promptness when it is wanted and in the quantities wanted. Shops that take the position that they are only run for repairing engines and cars cannot possibly be of assistance to the supply department in furnishing material. It must be clearly understood that the shops are run for the benefit of the railway.

There is probably no branch of the service that needs a more careful and thorough investigation than the manufacturing in our shops. It should be clearly and distinctly understood that the supply department is responsible for the stock, and that the shops should give it as good service wherever possible as would be received from an outside manufacturer. Where the conditions are practical such facilities should be under the direct supervision of the supply department.

The storekeeper should have such an organization as will permit him to be in perfect touch with the work going on at the shops each day; checking up the orders, delivering the raw material, taking away the finished products, etc. He will find this will overcome some of the delay and complaints regarding shop made materials and repairs.

Delivery by supply cars has been fully explained in another chapter, but it will do no harm to say that these cars are the connecting link between the storehouse and the users of material, and should be utilized to their fullest extent. These cars are in charge of store men, who actually deliver the material to the work and are in position to know that only what is wanted is delivered, and bring in everything that is on hand that is not wanted or can be spared. These cars, in addition to covering the division on monthly schedule, and distributing supplies for all ordinary maintenance and operation, to agents, trackmen, signal supervisors, plumbers, etc., should utilize the balance of the month in distributing supplies to local storehouses, roundhouses, car repair stations, etc., thus doing away with the cost of handling through the freighthouses, and incidentally delay and loss of shipments. They are transfer stores, and. as stated, are of unlimited aid to the economical operation of the division.

Their great value consists in the fact that they are able to actually deliver to the work just what is wanted when it is wanted, and where it is wanted, and pick up and bring in everything that is not wanted without opportunity for loss or delay, and render an accurate accounting for the same at the lowest possible cost for movement or handling.

Shop Deliveries.

The delivery of material to our shops is a matter which requires the most careful organization and supervision. It has been the practice on most railways for the men to call and get their material at the storehouse and supply depots. In order

to facilitate this many sub-stores have been established at convenient locations. In the absence of the shop delivery system, which has been described, this is the most practical thing to do. The objection to the sub-stores is that it necessarily means a very considerable duplication of stock, and you are never exactly sure that the thing wanted is in that particular place. Besides, it divides up your forces so that the full benefits of a concentrated organization are not obtainable.

The plan which the writer considers the best from every standpoint is the system of delivery by the supply department to the work. This is carried on in this way: To start with the material in the storehouse is all arranged in sections, that is, material of the same general character being grouped together in charge of a storekeeper, who does nothing but maintain this stock and deliver it. In each of these sections is a telephone which bears the same number as the section. In each shop there are several stations with telephones arranged conveniently, with cards tacked up, which show where the material is located. If a special item is required reference can be made to an indexed book arranged alphabetically, which shows the section each individual item is located in.

For example, the man engaged on air brake work wants something in his line. He calls up the storekeeper of Section 7, who has charge of this class of material, and tells him what he wants in his own way. Both these men are practical men, they are engaged every day in this work, and they can talk the matter over if necessary between themselves on the telephone. He tells him what he wants and goes away about his work. The section storekeeper takes this down on a sharp order, puts up what is wanted, rings the button for the delivery boy, a number of which are stationed at the foreman's desk the same as bell boys in a hotel. The boy takes the ticket and the material and delivers it to the man, who receipts for it. He brings the ticket back and delivers it to the storekeeper, who puts the time called on the ticket, time delivered, and puts it in his box. Thus you have the same system established that obtains in any of our large department stores.

The reason for the manual system is that these men may find when they make the delivery that it is not just what is wanted, they find out on the ground just what is wanted, and go back and make the exchange. Then again they are constantly in touch with the men that are doing the work, and can anticipate their needs. In other words, they are the connecting link between the storehouse and the job. This is of inestimable value to the supply department and to the company, for the reason that it keeps the mechanics at their work all the time, and it necessitates only the carrying of just what is wanted for the particular work at the time. It has been found by experience that each delivery can be made in an average of five minutes.

A full description of this system was presented to the Railway Storekeepers' Association by the writer in 1907, and it is appended hereto for more detail information, but the idea is simply this: Any system that permits high priced mechanics and their helpers to go any distance from their work and hold a post mortem, as it were, regarding materials is wrong, and should not be permitted, and there is absolutely no reason, if a proper organization is maintained, why a man cannot get what he wants delivered to him. There is no way that this can be done except by the man who is actually engaged in the work being in shape to connect personally with the man who has the material. This also cuts out the transferring and handling of these matters through the foreman, and gives him more time to attend to other work, which is of more importance. The expense of actually doing the work cannot be anywhere near as much, because the mechanics and their helpers will go for the material, and, if it is heavy, they will get someone else to bring it down for them.

Finally—the full purpose is to provide what is wanted when it is wanted as economically as possible, and that this can be done by an organization maintained and trained in this work, whose unit of efficiency is its ability to do this work successfully, more economically and better than any other department whose unit of efficiency is something else, is so apparent that it needs no discussion. The facts are that today, notwithstanding constant statements to the contrary, the service of our railway stores is probably 100 or more per cent. better than it ever was when departments were maintaining their own stocks, and is being done with at least 100 per cent. less money invested in material. But that it can be greatly improved there is no question, as the full value of prompt and efficient service is not yet fully understood or appreciated. The very criticism which the store system receives from other departments will eventually bring about the most efficient organization that can be devised.

ACCOUNTING.

No attempt will be made to go into the details of the accounting for material and supplies used. This matter is entirely in the hands of the accounting department, and varies with the various railways and policies of the owners and executives. The only matter relating to accounts with which we will deal is that which pertains entirely to the storekeeper's responsibility, and to the extent to which it applies to the economical operation of the department.

There is no question but what all the detail of accounting should be done by the division storekeepers on the ground. No other system is practical, for the reason that these men are the only ones that are in position to actually transcribe the results of operations from day to day.

The writer is strongly of the opinion that daily accounting is as preferable to monthly accounting as monthly accounting is to yearly. Or, in other words, for the purpose of knowing more accurately just what is going on, a system of daily accounting or estimates should be installed at each of the division stores of the property, whereby the division storekeeperes may know every day approximately how much business has been done, and what it has cost to do it. This information should be wired to the general storekeeper each night, and tabulated by him. This is done more to keep control of the material and the cost of doing the work than for any other one thing. This system is being followed on some of the large railways with excellent results. It does not cost any more to do in this way, and I do not believe as much.

The trouble with our accounting in the past has been that it has been too ancient. Current accounting is the greatest possible aid to the executive, and the only way he can keep control of, and familiar with his business. It does not do him any good to know what has happened 60 days, or a year before, he wants to know now. In fact the best accounting would be accounting which would tell him what was going to happen instead of what has happened. I think accounting ought to anticipate results as well as record them. So it is apparent that the successful storekeeper must be able to anticipate his transactions. Just how far in detail this can be done profitably is a question which the accounting department will have to decide.

Stock Books.

The stock book may not come directly under the head of accounting, yet it is really the basis of all supply department accounting and the most important record in it. The stock book is a register of everything that is on hand at a specific time. First, and of most importance, it is a technical description of the article, and it should be identified by a number. The book is arranged in columns by months and shows:

Average monthly consumption previous year,
Amount on hand first of each month,
Amount ordered during that month,
Amount on hand succeeding month, etc.

This book is in general use all over the country, and has been for a great many years.

These books should be prepared every year, and written up

CLASSIFIED STATEMENT OF MATERIAL ON HAND.....1910—BASED ON DISBURSEMENTS FOR EIGHT MONTHS ENDING AUGUST 31ST.

Class No.	Classification.	1st Division.		2nd Division.		3rd Division.		4th Division.		5th Division.		6th Division.		7th Division.		Total.		Class No.
		Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	Stock on Hand.	Day's Supply.	
1	Air Brake Material																	1
2	Axles, Car																	2
3	Axles, Locomotive																	3
4	Bearings, Journal (Car and Tender)																	4
5	Bolts, Rivets, Nuts, etc																	5
6	Car Furnishings, Fixtures, etc																	6
7	Castings, Rough Brass																	7
8	Castings, Rough Iron and Steel																	8
9	Couplers and Parts																	9
10	Fence Posts and Fence Wire																	10
11	Forgings																	11
12	Frogs																	12
13	Fuel																	13
14	Glass																	14
15	Hardware (Shelf)																	15
16	Hose																	16
17	Ice																	17
17½	Interlocking and Signal Material																	17½
18	Iron—Bar and Sheet																	18
19	Lamps and Lighting Material																	19
20	Locomotive Parts—Finished																	20
21	Lumber and Timber																	21
22	Material in Course of Manufacturing																	22
23	Metals																	23
24	Miscellaneous																	24
25	Oil—Car																	25
26	Oil—Engine																	26
27	Oil—Headlight																	27
28	Oil—Miscellaneous																	28
29	Oil—Signal																	29
30	Oil—Valve																	30
31	Paints																	31
32	Piles and Stock Yard Posts																	32
33	Pipe and Fittings—Cast																	33
34	Pipe—Wrot., and Fittings																	34
35	Rail—Iron, Second-hand																	35
36	Rail—Steel, New																	36
37	Rail—Steel, Second-hand																	37
38	Rail—Steel, Scrap																	38
39	Rail Fastenings																	39
40	Scrap, not Including Rail																	40
41	Springs—Car and Locomotive																	41
42	Stationery																	42
43	Steel—Bar and Sheet																	43
44	Switches and Fixtures																	44
45	Tie Plates, Brace Chairs, etc																	45
46	Ties—Cross																	46
47	Tires																	47
48	Tools																	48
49	Trucks, Brake Beams, etc																	49
50	Tubes																	50
51	Waste																	51
52	Wheels—Car																	52
53	Wheels—Locomotive																	53
54	Steamship Equipment																	54
55	Spare Machinery																	55
	TOTAL																	
	Less Rail, Scrap, Ties and Trucks																	
	Previous Month																	

Office of General Storekeeper.

Form for Statement of Material on Hand.
Actual form measures 13 in. x 17 in.

at the same time. This for the reason that the descriptions must be uniform, and for the further reason that the same item should appear in the same place in the book at each store on the railway.

It may be said that it is not necessary to write up items that are not carried at certain places. This can be answered by the statement that the stock book is really the catalog of the railway, and answers every purpose of a jobber's catalog, except the illustrations. So that the storekeeper that has a stock book is in position to order whatever may be called for at any time. There is no necessity for his carrying an article in stock just because he has it listed. The disadvantages of having these items is the bulk of the book, but this is more than offset by its usefulness.

After the stock books are all written up and delivered to the storekeepers, they must arrange their stocks to agree with the stock book, mark it exactly the same, and have it run in order. This for the reason that everything should be concentrated to save time and convenience in taking stock, which has to be done every month. The average monthly consumption is deduced from the previous year's business, and serves as a guide for future orders. It must not be used arbitrarily, but is an indication and a very valuable one.

A monthly inventory must be made, but it should be borne in mind that this stock-taking is for the purpose of ascertaining the sufficiency of the stock on hand, and is not intended to cover the value. It is usually carried on by two men, the section storekeeper and his helper, but if he has no helper the two section storekeepers join for stock-taking purposes. One man calls off the number of pieces on hand, the other man enters the amount with a hard pencil in the on-hand column. This stock can be taken just as rapidly as one man can make figures in his book. At the same time that he checks the amount on hand he should enter in the order column the additional amount he thinks he will require. This for the reason that the stock appears differently when actually seen than it does as an entry in a book. You might have fifty of an article shown in a stock book, and it might look like a great many, but if you were looking at the material itself, and knew by practical experience how many were being used, you would get an entirely different impression. Hence, it is important to put down at the time, in pencil, how many additional should be ordered, although it may be changed afterwards.

After this is done there should be brought forward and placed directly over the amount on hand the amount due; e.g., $\frac{24}{44}$ meaning that there are 44 on hand and 24 due on previous requisitions. The section storekeeper should look over carefully what he has ordered, taking into consideration the back-orders which he holds, the detailed information which he has regarding the conditions of the work going on, time of year, kind of deliveries he is receiving, and according to his best judgment enter in the amount that he thinks he ought to have of each item in his section. The book should then go to the storekeeper, who, in company with his store foreman, should go over the items thus ordered, making any changes which his further knowledge of conditions may warrant, and the requisition is then prepared accordingly.

It will be seen by this that an actual inventory of stock is taken every 30 days, consequently it is being constantly checked for errors and revised, with result that practically a current inventory is maintained. Constant inventories are the most important factor connected with the control of stock.

Receiving Records.

This is the second most important record, and is a diary of the entire transaction, from the time a requisition is made until it is completed, and the invoice or purchase bill passed for payment. It must start first with either a transcription of the requisition or a carbon copy of it. It has been found economical and desirable to make two forms of the requisition or receiving record and prepare them at one writing on a typewriter with a carbon. In addition this form will have columns to show—

Date received,
How received,
Amount received and the seller,
Point of delivery,
Routing,
Number,
Date,
Amount of invoice or purchase bill,
Amount of freight charges, if any,

and a column of remarks in which is entered the condition of the shipment, and a memorandum of the date the item was hurried. This book is of great value for tracing purposes.

The first information to be entered is the number of the order placed by the purchasing agent, the name of the seller, point of shipment, routing, etc. The purpose of checking this order against the requisition record first is to check the description with the description on the requisition, to note and correct errors in placing the order, if any are made. Besides it gives additional information of when and with whom the requisition was placed for tracing. The next information entered is the advice of shipment, either in the form of a shipping notice, bill of lading, or purchase bill. Herein is noted the date of shipment, what was shipped, from whom, checked against point of delivery and specifications.

The next entry is taken from the hip pocket "freight received book," which is the original receiving record, kept by the section storekeeper, in which is entered daily the material received in their respective sections. This entry (as explained in another chapter) gives reference to the date, car number and initial, waybill reference, how packed (boxes, bundles, crates, etc.), and the detailed checking of what they contain entered by the section storekeeper, who unpacks the material and puts it away. The contents of these books are transferred to the requisition or "freight received record," against each respective requisition, showing quantities received, date received, and how received. Thus it will be noted every particular item is identified. The next information is the purchase bill, which is checked against the receipt of material as regards quantities, descriptions, test reports, point of shipment, routing, and the amount and number of the purchase bill or invoice, and the freight charges. The proper certification is then made on the face of the original as to the receipt of the material, giving reference to the page in the receiving record, where it is to be found; thus having a complete history of the transaction from the time it originated until it closed, a most valuable permanent record thus can be obtained.

This book, in addition to being an accurate record of every requisition made and all material received, also serves the purpose of identifying each particular shipment, and each specific item. The book also shows everything that is outstanding, that is, obligations in the way of unfilled requisitions; is used entirely for tracing, and becomes without question the most valuable and useful record in a railway store. Its primary purpose is to make an absolutely complete record of everything ordered and everything received.

Issues.

The issues are all authorized, either by approved requisitions or shop orders, and covered, either by departmental invoices or direct charges to operating accounts. Department invoices are drawn to cover all materials issued on approved requisitions, and are simply a bill against the department making the requisition. These are usually prepared monthly from the daily manifests, which are made directly from the original requisitions, and sent to the head of the department, where they are checked against the receipted manifests, and if found correct approved for entry in that month's accounts. Shop charges, that is, material issued directly to the shops for work being done there, is usually charged direct to the operating accounts from the shop tickets, and the tickets either retained on file or submitted with the detail charges to the shop superintendent or master mechanic monthly. Transfers between stores are handled the same way as

Classified Statement of Material Received, Issued, and on Hand,

Department _____ Store _____ Division. Month of _____ 19____

Class No.	CLASSIFICATION	Unit of Measure	ON HAND FROM LAST MONTH		RECEIVED DURING THE MONTH				TOTAL TO ACCOUNT FOR		ISSUED DURING THE MONTH								ON HAND AT CLOSE OF MONTH	
					Purchases		Transfers				Charged Out		Transfers to Other Depts		Transfers to Other Stores		Sales		Total	
			Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1	Air Brake Material																			
2	Axles—Car	Lbs.																		
3	Axles—Locomotive	Lbs.																		
4	Bearings—Journal (Car and Tender)	Lbs.																		
5	Bolts, Rivets, Nuts, etc.																			
6	Car Bearings, Brass or Babbitt																			
7	Castings—Rough Brass	Lbs.																		
8	Castings—Rough Iron and Steel	Lbs.																		
8½	Commissary Stock																			
9	Couplers and Parts																			
10	Fence Posts and Fence Wire																			
11	Forgings	Lbs.																		
12	Frogs	No.																		
13	Fuel	Net Tons																		
14	Glass																			
15	Hardware (shelf)																			
16	Hose	Feet																		
17	Ice	Net Tons																		
17½	Interlocking and Signal Material																			
18	Iron—Bar and Sheet	Lbs.																		
19	Lamps and Lighting Material																			
20	Locomotive parts—Finished																			
21	Lumber and Timber	Feet																		
22	Material in Course of Manufacture																			
23	Metals	Lbs.																		
24	Miscellaneous																			
25	Oil—Car	Gal.																		
26	Oil—Engine	Gal.																		
27	Oil—Headlight	Gal.																		
28	Oil—Miscellaneous																			
29	Oil—Signal	Gal.																		
30	Oil—Valve	Gal.																		
31	Paints																			
32	Pike and Stock Yard Posts	No. Pcs.																		
33	Pipe and Fittings—Cast																			
34	Pipe—Wrought, and Fittings																			
35	Rail—Iron, second-hand	Net Tons																		
36	Rail—Steel, new	Net Tons																		
37	Rail—Steel, second-hand	Net Tons																		
38	Rail—Steel, scrap	Gross Tons																		
39	Rail Fastenings	Lbs.																		
40	Scrap, not including Rail	Net Tons																		
41	Springs—Car and Locomotive	Lbs.																		
42	Stationery																			
43	Steel—Bar and Sheet	Lbs.																		
44	Switches and Fixtures																			
45	Tie Plates, Frogs, Chairs, etc.																			
46	Ties—Cross	No.																		
47	Ties	Lbs.																		
48	Tools																			
49	Tools, Side Road, if Owned and Car Fitted																			
50	Tubes	Feet																		
51	Waste	Lbs.																		
52	Wheels—Car	No.																		
53	Wheels—Locomotive	No.																		
54	Steamship Equipment																			
55	Spare Machinery																			
	Total																			

I hereby certify that the above is a correct statement of the material received, issued, and on hand, belonging to this Department and under my charge _____ 19____

_____

_____

Dated _____ 19____

Form for Material Received, Issued and on Hand.

transfers to other departments, i.e., by departmental invoices. The storekeeper depends fully on the requisition for his authority for the issue of material, and any material issued without a requisition or an order is unaccounted for. Many other schemes of attempting to balance up special items, etc., have been put into effect and carried on to a certain extent, but they are impractical, and the only way to see that credit is received for everything that is issued is to have sufficient help to see that nothing is taken without a requisition.

Classification.

The classification of material is for the purpose of keeping track by classes of how much is used of each class, and is for the primary purpose of enabling the officers to have an intelligent idea of what the amount of material, in dollars and cents, of various classes is on hand as soon after the close of the month as possible. This record is of primary importance to the storekeeper and general storekeeper, and for the purpose of controling stock is probably of the greatest value.

In order, however, to obtain full benefit from this statement it must be intelligently classified, that is to say, it must be divided into sufficient classes so as to indicate clearly what it is intended to show, not generalize. At the same time, no more classes should be permitted than is absolutely necessary. With the exception of the one column, Class 24, miscellaneous, shown herewith, I consider it an entirely practical classification, and the best one the writer has seen. A miscellaneous class should be eliminated from any classification. After all, the real value of a classification is not so much the name and number of the class as it is to maintain the same thing all the time. All figures of a statistical nature are of little value except for comparative purposes.

The classification is arrived at briefly by abstracting, from the purchase bills, department invoices, and other charges to stock which constitute receipts or debits. The manifests, invoices against other departments, bills collectible and shop tickets are abstracted in the same way, and represent issues or credits. The results thus obtained are shown on a statement entitled Classified Statement of Material Received, Issued, and on Hand, and shows the amount on hand the previous month, received during the month, total to account for, amount charged out, transfers to other departments, transfers to other stores, sales, the difference being the balance on hand to carry forward to the succeeding month.

A statement of this kind is made up by each division store and from it is compiled the Classified Statement of Stock on Hand, which is the ultimate purpose of this statement, so far as the storekeeper is concerned, and forms the most concise and clear analysis of the condition of the stock of any statement produced. It can, of course, be sub-divided as finely as may be desired, but it is believed from 75 to 90 classes will segregate any stock as much as necessary.

The Classified Statement of Material Received, Issued and on Hand also serves the purpose of a balance sheet, in fact this is its primary use. The original goes to the auditor for this purpose, and is corrected by him; but the general storekeeper makes use of this same form for the purpose of obtaining as quickly as possible, after the close of the month, the actual condition of the stock.

Pay Rolls.

The pay roll is always a matter of grave importance, and one that must be watched closely during the month. The writer has found the system of daily accounting (carrying the disbursements down daily) to be of great assistance in controling the cost of operation, in cost per thousand dollars, or percentage of cost based on disbursements. While this is not by any means a fair criterion or representation of what is being done, still it forms the best unit of measure that the writer knows of. It is based on disbursements, it might be based on receipts; in fact it probably should be based on both, and generally is, but the purpose is to know how much it costs to handle every thousand dollars' worth of material in and out. Values enter largely into this, as well as the manner in which the work is done, but it is assumed, and known by all practical men, that statistics of this character have little value except to the general storekeeper himself in comparing his own results with previous results, and one division with another, with full knowledge of the conditions which govern. Comparisons with other roads and other methods, doing their business on a different basis in a different way, are of little or no value, and do not represent anything in particular; but where an officer maintains the same system of comparisons, year in and year out, in a short time he has a valuable guide, which is the most that can be said of a statement of this character.

The above may be said to embrace practically all the essential accounting, so far as the supply department is concerned. There are innumerable statistics and other valuable data prepared, connected with the buying, distribution and accounting for supplies, but my purpose has been simply to call attention to the vital factors which are absolutely necessary, and of direct and positive assistance to the supply department in maintaining what is wanted, accounting for it and controling it.

The final installment will deal with buying under contracts or agreements, how to install the plan, and weakness and strength of supply department organizations.

(To be concluded.)

STATISTICS OF EXPRESS COMPANIES FOR A YEAR.

The Interstate Commerce Commission has issued an abstract of statistics of express companies in the United States for the year ending June 30, 1909, made up from its first annual report on this subject. A uniform system of operating accounts was prescribed July 1, 1908. The report covers the operations of the 13 important companies. The service rendered by express companies consists in collecting shipments intrusted to their care at points of origin, in safeguarding such shipments in transit, and in delivering them to consignees at destinations. Transportation proper is furnished by railway and other carriers, and the expense of such transportation is included in the operating expenses of those carriers. In addition to the service referred to, express companies do custom house brokerage, the order and commission business, and issue money orders, traveler's cheques, etc. The service performed by an express company touches the service of the post office and banks on the one side, and the freight service of railways on the other. Competition among express companies seems to exert very little influence upon express rates.

There is no recognized unit of service for the express business corresponding to the ton-mile, and selection was made of the "piece handled" as the unit best suited for statistical purposes, and the companies were required to render special statements showing the number and weight of pieces handled (exclusive of money and valuables) and the amount of revenue accruing therefrom during the months of April, August and December, 1909. The average revenue per piece and per pound was lowest in August and highest in December, with April about a mean between the other two. The figures contained in the summary compiled from the special statements on traffic movement show that the average revenue per piece received by express companies for the three months named was 50.49 cents, the average revenue per pound was 1.54 cents, and the average weight per piece was 32.80 pounds. Pieces weighing 100 pounds or less represented 95.01 per cent. of the total number, 74.06 per cent. of the total weight, and 83.69 per cent. of the total revenue.

Figures compiled from the statements rendered by 11 companies for the months of April, August and December, 1909, show an average revenue of 50.64 cents per piece. Of this amount 24.07 cents was paid to railways and other carriers for express privileges, 20.52 cents was paid for operating expenses, and 0.33 cents for taxes, this leaves an average operating in-

come to the express companies of 5.72 cents per piece handled.

The total mileage on June 30, 1909, covered in the operations of the 13 companies, was 260,507 miles, excluding ocean mileage and mileage in foreign countries, except Canada and Mexico. Of this total, the express mileage on steam roads was 238.961 miles; on electric lines, 6,414 miles; on steamboat lines, 14,138 miles, and on stage lines, 993 miles. The company which operated the greatest mileage was Wells Fargo & Co. with 65,698 miles, followed by the American Express Company with 48,224 miles, the Adams Express Company with 34,360 miles, and the Southern Express Company with 33,181 miles. The two companies operating the smallest mileage were by the National Express Company with 1,714 miles, and the Globe Express Company with 1,899 miles. All the large companies operate in many states, and with the exception of six states, all the states are served by more than one express company.

The cost of real property used in operations by the express companies on June 30, 1909, was $14,932,169, and the cost of equipment, $7,381,405, making a total of the book value of property and equipment for the 13 companies of $22,313,575.

The income account shows gross receipts from operations amounting to $132,599,190, from which there were deducted payments for express privileges amounting to $64,032,126, leaving as operating revenues $68,567,064, the amount with which the operating expenses should be compared. The operating expenses for the year covered by the report were $56,273,055, and the net operating revenue $12,294,008. The figures show that the express companies operated on a basis of 82 per cent. of operating revenues. A relatively small amount of property is necessary for the transaction of the express business and considerable expense is incurred for services that require practically no equipment. The operating ratios of the companies varied from 47 per cent. for the Great Northern to 92 per cent. for the United States Express Co.

After the deduction of taxes, $906,519, from net operating revenue there remained $11,387,489, to which was added $5,232,467, representing principally income from securities owned. After the deduction of interest, $1,047,280, and miscellaneous items, $190,122, there remained a net income of $15,382,553, out of which dividends amounting to $4,326,939 were declared. In addition, there were $2,223,089 dividends declared out of surplus.

The combined general balance-sheet statement shows that the total assets of the 13 companies were $186,221,380. The most significant fact shown by this statement is that the record value of the property used in operation by the express companies is but 12 per cent. of the total assets. The total investment as shown by the value of real property and equipment is but 25 per cent. of the capital liability as represented by the capital stock and funded debt reported. It is evident that the amount of capital stock of these companies bears no relation to the amount invested in the conduct of the express business.

Express companies hold $4,662,658 of the stock of express companies; they hold $20,471,942 of the stock of railway companies, and railway companies hold $14,124,000 of the stock of express companies.

The report contains a brief outline of the history, organization, and capitalization of the 13 companies. The names of the directors of these companies are given and the official relations of certain directors with other transportation agencies are shown as of June 30, 1909. An appendix contains tables illustrating the working of the scale of graduated charges by showing the average returns from shipments of given weights at certain base rates per 100 lbs., and there is an analysis of the application of the single, double and triple graduates to shipments taking selected rates. The changes made in rules and in the classification of commodities shipped by express which affect the charges on the shipments, 1909, are set forth, compared with 1896.

INCREASES OF EARNINGS AND EXPENSES OF EASTERN RAILWAYS FOR FIVE MONTHS.

The following figures have been compiled by the Bureau of Railway Economics to show the increases in earnings and expenses on 22 eastern railways during the five months ended November 20, 1910. They are particularly interesting because of their bearing on charges that the railways recently have been padding their expenses to influence the decision of the Interstate Commerce Commission in the rate advance cases. If such padding had been done it would naturally show in the statistics in the form of excessive increases in the maintenance of way and equipment accounts. It will be noted, however, that the increases in these accounts have been comparatively small, while they have been very large in the conducting transportation account, where the effect of the advances in wages would be most evident. While the *percentages* of increase in the traffic and general accounts have been large, the *absolute* increases have been relatively small, and are of less significance. Probably these increases are largely due to the expenses involved in handling the rate advance cases and similar matters.

The estimate of the increase in wages ($13,015,745) is based on the percentages of increases that actually have been made during 1910 to the various classes of employees.

INCREASES IN EXPENSES FOR FIVE MONTHS ENDING NOVEMBER 30, 1910, OVER SAME PERIOD IN 1909.

		Operating Revenues.	Maint. of Way.	Maint. of Equip.	Traffic.	Transp.	General.	Total.	Net operating Revenue.	Taxes.	
1.	Baltimore & Ohio	$2,111,350	$181,591	$638,617	$130,646	$2,448,667	$121,161	$3,520,682	d $1,409,332	$126,390	1
2.	Pennsylvania Railroad	905,170	259,727	199,650	131,338	2,753,694	170,095	3,514,504	d 2,609,334	.....	2
3.	Pennsylvania Company	872,921	125,930	531,868	68,199	1,328,103	60,670	2,114,770	d 1,241,849	140,903	3
4.	P., C., C. & St. L.	1,005,195	45,181	416,500	55,232	1,254,736	38,865	1,810,514	d 805,319	137,092	4
5.	Vandalia	568.047	d 1,142	136,837	18,958	400,051	5,448	560,152	7,895	21,199	5
6.	G. R. & I.	100,633	46,650	19,784	7,826	139,261	7,597	221,118	d 120,485	16,747	6
7.	N. Y. C. & H. R.	1,873,540	614,846	429,660	4,186	1,786,807	295,720	3,131,219	d 1,257,679	45,296	7
8.	L. S. & M. S.	716,327	872,874	456,179	42,307	1,365,998	93,445	2,830,803	d 2,114,476	114,783	8
9.	Michigan Central	649,874	365,931	319,612	57,150	974,141	46,211	1,763,045	d 1,113,171	55,450	9
10.	C., C., C. & St. L.	781,598	418,729	357,859	50,737	1,146,843	59,012	2,033,180	d 1,251,582	40,000	10
11.	L. E. & W.	72,715	47,018	53,839	24,056	116,135	10,773	251,821	d 179,106	2,959	11
12.	Erie	1,136,441	237,985	76,542	66,185	421,736	d 6,576	795,872	340,569	46,804	12
13.	Lehigh Valley	465,419	43,462	78,729	56,949	658,567	24,467	862,174	d 396,755	d 7,200	13
14.	D., L. & W.	11,667	457,373	159,980	43,992	482,630	4,705	1,148,680	d 1,137,013	20,750	14
15.	Chesapeake & Ohio	434,869	196,466	14,815	5,270	531,917	63,441	811,909	d 377,040	46,250	15
16.	Norfolk & Western	1,015,731	358,648	385,887	20,961	498,218	9,527	1,273,236	d 257,505	45,000	16
17.	Boston & Maine	681,391	182,104	277,880	17,864	936,654	57,549	1,472,051	d 790,660	30,287	17
18.	N. Y., N. H. & H.	1,200,869	270,555	237,441	11,111	724,839	110,783	1,354,729	d 153,860	42,000	18
19.	N. Y., C. & St. L.	351,153	169,648	185,238	19,811	273,812	12,775	661,284	d 310,131	7,500	19
20.	C., H. & D.	11,351	d 250,862	21,220	17,384	312,833	d 28,276	7[illegible]299	d 60,948	16,948	20
21.	Pere Marquette	172,213	d 31,767	134,948	41,267	422,526	24,617	591,591	d 419,378	58,212	21
22.	Wabash	688,746	d 37,025	335,388	10,461	456,035	14,879	779,738	d 90,992	.....	22
	Total increase	$15,827,220	$4,573,917	$5,468,473	$901,890	$19,434,203	$1,196,888	$31,575,371	d $15,748,151	$1,007,370	
	Total 1909 figure for same period	$395,518,436	$48,720,603	$60,487,419	$7,609,552	$124,345,080	$7,669,325	$248,831,979	$146,686,457	$13,711,603	
	Per cent. of increase	4.0	9.4	9.0	11.9	15.6	15.6	12.7	d 10.7	7.4	

Note.—Wage increase estimated at $13,015,745. d = Decrease.

The section of the Buneos Ayres Midland Railway from Rica to Carline was constructed at a record speed for Argentina; working out at about three-quarters of a mile a day.

Shop Section.

THE car department competition, previously announced, will close February 15. The conditions are such that the competition is open to all of our car department readers, the only requirement being that the articles submitted must relate to some subject or subjects of interest or importance to foremen in the car department. For instance, the article might discuss such topics as the best way of making a certain kind of repairs or the best material to be used for a given service. The efficiency of a shop or repair yard may often be improved by changing the method of organization or of handling the equipment. If you have accomplished results in this way, tell us how you did it. There are great possibilities in the car repair yards for the use of reclaimed or second-hand material. The introduction of all-steel and steel underframe equipment has made it necessary to provide new tools and facilities on many roads, and exact information as to how different classes of this work are handled will be appreciated by many of our readers. The passenger car repair shop and its auxiliaries cover a wide range of work, including several trades, and very little has been published along the lines of shop operation and shop practice for this class of work; we should like to have several articles relating to it. The maintenance and cleaning of passenger equipment also offers an attractive field for good articles. The article may be made just as long or short as you think best in order to tell your story clearly. The best paper will be awarded a prize of $35, and the second best a prize of $20. Papers which are not awarded prizes but are accepted for publication will be paid for at our regular space rates.

REMEMBER the engine house kink competition which is to close March 15. The engine house is "the neck of the bottle," controlling the time that locomotives must be held out of service, and it is necessary that the work be done properly and with the greatest possible despatch. All engine houses have good kinks, although in many cases the men have become so accustomed to their use that they may not realize their importance. A first prize of $35 will be awarded for the best collection of two kinks, and a second prize of $20 for the second best. More than two kinks my be submitted, allowing the judges to base the decision on what they consider to be the best two in each collection. Kinks accepted for publication but not awarded a prize will be paid for at our regular rates.

A COMPETITION on the instruction of workmen and apprentices will be held, closing April 15. This subject presents great possibilities, for every foreman is confronted with the problem of properly instructing and developing his men to do better and more efficient work and also to recruit the ranks by apprenticeship. Concerning the latter subject, important developments have taken place within the past few years. Modern apprenticeship systems, differing vitally from the old methods and including complete and careful instruction in both theory and practice, have been installed on a number of railways. The instructors and the men in charge of this work are confronted with many problems. What are these problems, and how have you overcome them? How is it possible to get the best results in handling apprentices on a small road or in a small shop, where it is impossible to provide the elaborate courses and facilities for instruction which are common in the apprentice schools at the larger shops? What does the apprentice boy think of his future and of the apprenticeship system? If you have a bright lad in your shops, encourage him to send in an article telling what he thinks of his opportunities in the railway shop and how he feels about the efforts which are being made in his behalf. The subject, as outlined above, also covers an even more important field, that of the instruction of workmen who have not had the advantages of a good apprenticeship course and whose efficiency can be greatly increased by proper instruction. We are more or less accustomed to hear of the title of "shop demonstrator," although it was an unknown term in railway shops ten years ago. What results are we getting from these demonstrators, and how do they carry on their work? Have not the results been sufficient to warrant using them more extensively? Then there are the handy men or laborers who constitute quite a large proportion of the shop force, and many of whom are ambitious and capable of filling much better positions if they can be properly developed and trained. What are you doing to develop these men, and what results have you obtained? The article should contain from 500 to 1,500 words. A prize of $35 will be given for the best article and $20 for the second best. Articles not awarded prizes, but which are accepted for publication will be paid at our regular rates.

M. H. WESTBROOK, of the Grand Trunk at Battle Creek, Mich., was awarded the first prize of $50 in the shop kink competition which closed January 15, and R. G. Bennett, motive power inspector at the South Pittsburgh shops of the Pennsylvania Railroad, Pittsburgh, Pa., was awarded the second prize of $25. The competition was a particularly successful one and the judges had great difficulty in selecting the winners. There were 16 other contestants, as follows: Frank J. Borer, foreman air brake department, passenger car shops, Central Railroad of New Jersey, Elizabeth, N. J.; R. E. Brown, machine foreman, Atlantic Coast Line, Waycross, Ga.; H. L. Burrhus, assistant to general foreman, Erie Railroad, Susquehanna, Pa.; W. H. Fetner, master mechanic, Central of Georgia, Macon, Ga.; T. E. Freeman, general foreman, Chicago, St. Paul, Minneapolis & Omaha, Sioux City, Iowa; John V. Le Compte, foreman, Baltimore & Ohio, Garrett, Ind.; C. C. Leech, foreman, Pennsylvania Railroad, Buffalo, N. Y.; Charles Maier, engine house foreman, West Jersey & Seashore, Atlantic City, N. J.; "Old Railroader"; A. G. Pancost, draftsman, Elkhart, Ind.; William G. Reyer, general foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; Theodore Rowe, general foreman, Great Northern, Jackson street shops, St. Paul, Minn.; P. F. Smith, chief draftsman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.; W. H. Snyder, assistant general foreman, New York, Susquehanna & Western, Stroudsburg, Pa.; William H. Wolfgang, draftsman, Wheeling & Lake Erie, Toledo, Ohio; H. C. Wilson, foreman tool room, Southern Railway, Spencer, N. C. Space only permits the reproduction of three of these collections, all of which are exceptionally large, in this number. The collections as a whole were exceptionally good, and all of them will be used, the remaining ones appearing in future issues.

THE paper on The Apprentice System as Seen by One of the Apprentices, written by Richard Keefe, an apprentice on the New York Central & Hudson River at Oswego, N. Y., and reproduced on another page in connection with the abstract of the proceedings of the fourth annual apprentice instructors' conference of the New York Central Lines, should appeal to those who are interested in the education of apprentices in railway shops. No foreman or instructor can really be successful in this work unless he can place himself in the boy's position and see things from his viewpoint.

ONE of the speakers at the New York Central's Lines' apprentice instructors' conference emphasized the importance of educating the apprentices and workmen to the necessity of making the proper use of safety guards and such other measures and regulations as are provided to protect the workers from in-

jury. After all the conservation of human energy and life is of far more importance than the conservation of material or other resources. The United States Steel Corporation has done splendid work in safeguarding its employees against injury and takes a justifiable pride in it. The Industrial Safety Association has recently established a museum of safety in the Engineering Societies' building, New York, which contains a large number of safety devices. Valuable as such devices are, their effect may often be lost due to misuse unless the employees are educated to a realization of their importance.

SCIENTIFIC MANAGEMENT.

THE editorial on scientific management and the article on The Mistakes of the Efficiency Men, which appeared in the *Railway Age Gazette* of January 6, have brought forth considerable comment, and three representative letters which we have received concerning them are published in another part of this issue. W. J. Harahan, vice-president of the Erie Railroad, has summed the matter up simply and in a common sense manner. L. H. Turner, superintendent of motive power of the Pittsburgh & Lake Erie, explains why the cost of maintaining freight cars on his road is so low and why it cannot be used as a standard for other roads to work to. C. J. Morrison, consulting engineer of New York, who was identified with Mr. Emerson's work on the Santa Fe for several years, takes up the cudgels in Mr. Emerson's cause, and his arguments are replied to by "One Who Has Worked With Them." The value and effectiveness of scientific time studies cannot be questioned, and it is unfortunate that the art of making them was not developed during the early days of piece work, or is not appreciated by many who are trying to establish piece work today. The making of these time studies is, however, of just as great importance in a day-work shop as in one where the men are paid by piece work or on a bonus system. To get the best results it is necessary for those in charge to know exactly what each piece of work is costing and to analyze the various operations scientifically to make sure that the work is being done in a proper manner and at the lowest cost. In shops where piece work prices have been established in a haphazard manner, time studies should be made to check these prices and to intelligently revise them. If by making these studies the men can be shown that they are wasting time and effort in doing the work, no difficulty will be found in adjusting the prices to the mutual advantage of both parties.

Mr. Morrison has presented certain figures concerning the operations of the mechanical department on the Santa Fe which apparently show that a considerable saving was made in 1906 and 1907, due to the application of Mr. Emerson's methods. It is difficult to draw any general conclusions from such figures unless all the facts surrounding the case are fully known. With no intent to question the correctness of Mr. Morrison's figures or his conclusions, but rather to emphasize the necessity of analyzing such figures carefully by taking into consideration the various factors which may effect them, the following data has been taken from statistics specially prepared for the Interstate Commerce Commission in order that comparisons may be made extending over the past ten years. The number of new locomotives for each year is taken from the annual reports of the railway.

Year ending June 30.	Number of locomotive miles.	Cost per mile run—cents.	New locomotives.
1901.....	25,404,000	7.36	52
1902.....	25,408,000	8.70	207
1903.....	32,151,000	8.17	75
1904.....	32,485,000	10.88	156
1905.....	34,555,000	12.60	31
1906.....	38,302,000	9.67	192
1907.....	41,648,000	9.29	128
1908.....	41,005,000	11.52	81
1909.....	39,642,000	9.61	...
1910.....	46,793,000	10.75	54

It must be admitted that the cost per mile run is not the best figure to make comparisons with, but unfortunately the ton-mile statistics are not available in the special data which has been prepared for the Interstate Commerce Commission. The cost of locomotive repairs per train-mile undoubtedly increases as the locomotives grow larger and their capacities increase. Mr. Emerson went with the Santa Fe in February, 1904. The strike which took place on that road beginning in May, 1904, was one of the worst that has ever occurred on any railway in this country. It is quite generally admitted that for a year or two from the time such a strike commences the cost of repairs and renewals to locomotives is necessarily much higher than for the preceding or succeeding years. Examining the cost per mile beginning with 1901, it will be seen that it does not vary greatly for the first three years. Beginning with the year ending June 30, 1904, the cost jumps from 8.17 cents for the preceding year to 10.88. As the strike did not commence until May, 1904, it might appear that it had been anticipated, and that more money had been expended for the fiscal year ending June 30, 1904, than might otherwise have been done. In 1905 the cost of repairs per locomotive mile jumped to 12.60, an abnormally high figure considering the previous record. The strike lasted practically only about a year, although it was not officially called off until a much later time.

During the strike a large amount of finished locomotive parts had been ordered, and at its close a considerable portion of these were in stock, which would naturally reduce the cost of repairs for the period immediately following. In 1906 and 1907 we find the cost per mile falling back to 9.67 and 9.29, respectively. Compared to the years 1901, 1902 and 1903 this figure would seem to be quite reasonable, for undoubtedly the size of the locomotives and their capacity had increased, at the same time increasing the cost of maintenance per mile run.

Another factor must also be taken into consideration. For the first year, and in many cases for the first two years after new equipment is received on a road it will cost only about one-half as much to maintain it as it does after that period. A study of the column showing the new locomotives added each year indicates that for the years 1902, 1904, 1906 and 1907 a large number of new locomotives were purchased, and if these were received in the early part of these fiscal years the tendency would be to reduce the cost of repairs per locomotive mile for those years. However, this may not have held true for the reason that the balanced compounds which were purchased in large numbers during this period gave considerable trouble when they were first placed in service.

It seems quite possible, therefore, that Mr. Emerson's methods should not be given the entire credit, if any credit at all, for the apparent good showing made for the years 1906 and 1907. It is no secret that during Mr. Emerson's entire stay on the Santa Fe he encountered strong opposition in several quarters, and immediately after he left the road the expenses in the motive power department increased greatly, due to a reaction, which under the conditions might naturally have been expected. In 1909 the cost fell to 9.61, but increased in 1910 to 10.75, or to very nearly what it had been for the fiscal year ending June 30, 1904. Just what caused the increase during the past year does not appear.

This rough study, which is incomplete, has been made not to controvert Mr. Morrison's conclusions, but to indicate that it is not safe to compare statistics of this kind unless all the facts in the case are known and allowance is made for those features which might have an appreciable effect on them. There are other important factors which should be checked such as the amounts charged off for depreciation and renewals each year, etc.

There is hardly a mechanical department in the country that has not made an apparently splendid showing for some one year by reclaiming material that had been charged out to it but which was lying idle, either being misplaced or forgotten, or because of the stock being carried in too large quantities. The effect of cutting this stock down is to make a good showing in

the operating expense for the year, but it is simply due to the extravagance of former years and in the following year when new material must be purchased, the maintenance expense goes back up. An important part of the betterment work on the Santa Fe was the careful study of this problem and the reclaiming of large amounts of material, which undoubtedly helped to make the good showing during 1906 and 1907. However, it should not have been necessary to retain an efficiency engineer to do this.

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Mr. Emerson has taken us to task for the statement in the editorial on scientific management in our issue of January 6 that "Mr. Emerson was given a fair trial in the mechanical department on the Santa Fe (three years), and claims to have saved the road $5,000,000 in that time." Charles B. Going, editor of the *Engineering Magazine,* preceded Mr. Emerson on the stand and prepared the way for his testimony, and one of the last things he said before Mr. Emerson was called was that a report had been made by the mechanical officials to the operating vice-president of the Santa Fe which showed that based on a tractive power unit, the savings due to the introduction of Mr. Emerson's methods for the three years had been calculated to be in excess of $5,000,000. Mr. Emerson did not correct this statement, and we assumed that it met with his approval.

Mr. Emerson also wishes to have another fact emphasized which may best be done by quoting as follows from the lecture he delivered at Harvard University. "Mr. Emerson had neither official position nor executive authority. He investigated, planned and then advised. He taught the underlying principles, showed the methods of research. Executive orders were issued and the work required was undertaken by the regular shop officials and force. Outside of his own office assistants, the specialists he selected and recommended were appointed by the regular officials and owed obedience to them. If important orders were necessary they were issued by the superintendent of motive power or by Mr. Kendrick, vice-president. Because the plans were new, untried, and because of the great interests at stake involving safety to life, full control was retained throughout by the regular officials."

MECHANICAL ARTICLES DURING JANUARY.

THE following articles of interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of January 6:

The Screw Reverse Gear. The reverse gear as used on locomotives in this country does not permit an easy and accurate adjustment of the cut-off, especially on the larger locomotives, and it might be well to consider the use of the screw reverse gear, which is extensively and successfully used abroad.—January 13, page 72.

The Use of Bridges in Exhaust Nozzles. W. E. Johnston explains why the exhaust nozzle with a bridge sometimes gives better results with the inside stack.—January 13, page 73.

The Effect of High Temperature on Locomotive Cylinders and Valves. It does not seem wise to use superheat of 550 deg. Fahr. on old locomotives with flat slide valves and ordinary design of cylinders. Special attention should be given to the design of these parts for locomotives using highly superheated steam—600 to 650 deg. Fahr.—January 20, page 110.

Test of Simple Atlantic Type Locomotive on the Testing Plant at Altoona. This locomotive was to have been tested at the St. Louis Exposition in 1904, but has since been tested at Altoona. Its performance is compared with that of the compound Atlantic type passenger locomotive which was tested at St. Louis.—January 20, page 125.

Federal Boiler Inspection Bill. The substance of this bill, which has passed the Senate and is now in the House Committee, is given.—January 20, page 126.

Lignite Fuel for Locomotives. The roads in the Northwest have given this subject considerable attention during the past few years with the view of taking advantage of large lignite deposits in that section, thus obviating the hauling of coal for long distances.—January 27, page 150.

Mikado Locomotive for Burning Lignite; Oregon Railroad & Navigation Co. This locomotive was especially designed for burning lignite coal, and has given splendid results. Its performance burning lignite is compared with that of a consolidation locomotive burning Cumberland coal.—January 27, page 167.

The Supply Department. The series of articles on this subject by H. C. Pearce, general storekeeper, Southern Pacific, which was started in the issue of January 6, has been continued during the month.—January 13, page 85; January 20, page 112 and January 27, page 161.

STANDARDIZATION OF CHILLED IRON CAR WHEELS.

THE paper on The Standardization of Chilled Iron Car Wheels with Reference to Service Conditions, which was read by a representative of the Griffin Wheel Company at the January meeting of the Western Railway Club, presents a new phase of the chilled wheel question which is so important that we publish a liberal abstract of it in this issue. The subject is one which evidently deserves further attention from the wheel committee of the M. C. B. Association, as the paper seems to show that there are some classes of service to which the standard weight M. C. B. wheels are not suitable, and some further standardization in detail should be adopted for the weight of wheels for refrigerator and furniture cars, tenders and passenger cars.

In addition to the gross load on eight wheels the braking power should be considered, and an additional thickness should be added to the plate to take care of the stresses due to the heating of the wheel when the brakes are applied. The thickness of the tread should also be increased for this reason. The whole question of wheel design is therefore involved in the problem of adapting the cast wheel to the more severe conditions which are found in some classes of service. To assist in this work the Association of Manufacturers of Chilled Car Wheels has prepared a number of tables which show the thicknesses of plate and tread and the weights of wheels for various gross loads and total braking power. These tables are included in the paper. Unfortunately, they are not accompanied by an explanation of the manner in which the wheel proportions were arrived at, though we are asked to accept them with the same confidence as the tables which apply to the strength of beams, channels and other rolled steel sections. A rational theory for the design of car wheels must involve a consideration of a combination of stresses which are difficult to measure, and as they have not been exactly measured wheel design cannot be considered as having an exact basis. It is surprising to find that the lateral stresses due to the blow on the flange are not mentioned in the paper, but they are probably assumed to be proportional in some way to the gross load acting under velocities due to normal running speeds.

The tables of cast iron wheel proportions, as prepared by the wheel makers, should, therefore, be regarded as a tentative presentation of our present knowledge of the subject rather than exact or final figures which will bear rigid analysis. They are the result of a careful study of records relating to the life and service of a large number of wheels, and as such can be accepted as the best available guide for present practice.

With increased loads and speeds heavier braking is required, and the stresses due to the heat generated by severe brake shoe applications are greater than ever. The proper design of the cast wheel is, therefore, becoming more important. Considering the amount of money involved, in addition to the question of safety there is no more important subject for the M. C. B. Association to investigate than the design and composition and the method of manufacture of the chilled cast wheel. These questions have been left largely with the wheel makers, but there should be a fuller co-operation of the railways, not only in this development, but in the further standardization of wheel application with reference to the character of the car and the kind of service.

It is claimed that the cast iron wheel is so safe that if properly made and applied in accordance with the rules proposed there would not be one broken wheel in one million. The manufacturers are so confident of this that they have no hesitation in recommending chilled wheels for all classes of railway service, and they see no indication of the limit of its capacity having been approached. In adapting wheels of various weights to particular services, the paper proposes that the 675-lb. wheel be abandoned and the 725-lb. wheel can be used under both 80,000-lb. and 100,000-lb. cars, because in many cases there is little difference in the requirements of these two classes and bet-

ter service would be secured for the 80,000-lb. class. The 700-lb. wheel is recommended for refrigerator, furniture and other heavy cars of the 60,000-lb. class and also for the 70,000-lb. class. The 625-lb. wheel should be used for other ordinary 60,000-lb. and less capacity cars. The arguments for this change, as presented in the paper, appear to be reasonable, and the suggestion relating to more rigid rules concerning wheel application are worthy of the careful attention of all who are interested in car service and maintenance.

The paper may be regarded as a statement of the position of the wheel manufacturer as to the cast iron wheel. It reiterates what has been repeatedly stated in these columns, that the cast iron wheel is capable of being improved and made more suitable for the work that it has to do, but it puts the greatest stress on the advisability of adding to the weight and skims over with the barest of allusions to the possibility of improving the metal. It is on this last point that especial emphasis has been put by railway officials. It is a timely appeal from the manufacturers for consideration, especially in view of the inroads that are being made in their field by the steel wheel. It is undoubtedly quite sincere in its statements, and while we may be disposed to accept it with considerable hesitation, we can attribute to the enthusiasm of the author the closing statement to the effect that the cast iron wheel makers can furnish "the safest wheel made of any material." This in view of our almost total ignorance of the actual stresses to which a car wheel is subjected is putting it rather strong.

Letters to the Editor.

SCIENTIFIC MANAGEMENT.

New York, January 14, 1911.

To the Editor of the Railway Age Gazette:

I have read the editorial on scientific management in the *Railway Age Gazette* of January 6, and think it is in line with the conditions. The trouble with the efficiency exponent seems to be that he thinks he can lay down certain hard and fast rules, and that all events can then be made to fit in with the carrying out of such a proposition; that he can calculate to a theoretical nicety the results as they must occur, largely irrespective of business conditions. It seems to be his idea that because the railways do not handle their business along such lines that they are not carrying out the proper business principles. I believe someone has shown that if the amount which it is claimed could be saved—one million dollars per day—was accomplished, it would be necessary to wipe out a very large part of the expenses of the mechanical department, in which department a large part of the saving was evidently to be made. The saving would necessarily have to be largely in labor because as a general proposition railways buy as much material as they can from outside manufacturers under competitive conditions.

There is no question but that the railways require scientific management to the fullest extent, and, to my mind, the most effective way to bring about scientific management is in the predetermination of expenses so far as it is possible to do so, and, it is possible to do so to a very great extent. In the predetermination of expenses it is, of course, essential that all the conditions surrounding the business shall be carefully considered, and that line of action adopted which means the greatest good to the railway as a whole, considering both its prospective revenue and expenses. The offhand manner in which some efficiency men have announced that they could make a saving of large amounts without the knowledge of the conditions affecting the property that they seek to improve, has, it seems to me, militated against them. No railway man will venture an opinion as to whether another railway is being operated more or less economically because he knows the varying conditions surrounding the operation of different roads are so necessary of explanation; before a full understanding may be had. There is no question but that the efficiency man has done good, as everybody else does good who enunciates any idea of improvement to a sufficient extent to impress other people. I believe that stern necessity has done more than anything else to absolutely require efficient operation. There are some railways on which it is so essential that it becomes an absolute necessity. The example in the results produced forces other roads to adopt measures accomplishing the same thing. In any event the competent operating railway officer must be cognizant of the necessity for proper management, and be capable of devising the necessary means for it, otherwise he does not deserve to be designated as competent.

W. J. HARAHAN,
Vice-President, Erie Railroad.

Pittsburgh, Pa., January 20, 1911.

To the Editor of The Railway Age Gazette:

The editorial on scientific management in the *Railway Age Gazette* of January 6, mentions the cost of maintenance of freight cars on the Pittsburgh & Lake Erie, as referred to by Harrington Emerson before the Interstate Commerce Commission. The commission is made up of able, earnest, and just men, who are prompted by one thought only, to do justice to all concerned, and ascertain, if possible, everything bearing on the case which will enable them to deal impartially with the question before them. Mr. Emerson in referring to the Pittsburgh & Lake Erie, either ignorantly or intentionally misled the commission. He knew, or should have known, that there is no road in this country that has better facilities for the maintenance of its equipment, and that very few, if any, have as good; he should also have known and stated that the average age of freight cars owned by the Pittsburgh & Lake Erie is six years and eight months, which tends to produce a low cost of maintenance. Moreover about 73 per cent. of this equipment is of all steel construction.

The writer's remarks before the Railway Club of Pittsburgh made no reference whatever to the operation of the Pittsburgh & Lake Erie, but treated the subject from the standpoint of the average conditions which prevail throughout the country. Men who have a general knowledge of the railway situation are familiar with the fact that the Pittsburgh & Lake Erie is distinctive and peculiar in many respects, and that it cannot fairly be used as a standard of comparison. Much capital seems to be made of the fact that the writer was not informed as to the cost of repairs on his own road. The Pittsburgh & Lake Erie computes the cost of car repairs on the cost per mile run, not on the cost per car per year. Freight rates are based on the cost per ton per mile hauled; why should not car repairs be based on the cost per mile? During 1909 the average mileage per day for the freight cars operated by the Pittsburgh & Lake Erie was 12.47 miles, while the average for the country, as nearly as can be learned, was about 22 miles. This was due to the nature of the business and the short haul which makes a correspondingly high terminal delay that cannot be avoided. Had the cars on the Pittsburgh & Lake Erie made the average mileage, the cost per car for maintenance would have been increased $23.57, or to a total of $54.58 per car per year, or $0.068 per car mile. The conditions on the Pittsburgh & Lake Erie are therefore unusual, and it should not be used as a basis for deciding matters for the other lines.

Mr. Emerson should confine himself to general conditions, and not select special and isolated cases to be used as a guide for others who are not so fortunately situated, and in consequence cannot reach the high standard of efficiency that comes so easily in special cases. He should also realize that in giving testimony before a tribunal of able and just men, any attempt upon his part to present only such results as are obtained under the most ideal conditions, or the failure to mention any facts which would throw a greater light upon the subject, is regarded as an attempt to mislead or give a wrong impression, and is, in a manner, a distortion of the truth.

Mr. Benjamin Baker, in his article in the *Review of Reviews*

of January, 1911, under the heading of Efficiency, Freight Rates, and Tariff Revision, refers to the work of the writer as a "humorous situation." With the highest regard for the opinions of Mr. Baker on subjects with which he is conversant, and with no desire to say unkind things, we are impelled to believe that Mr. Baker could in no other way have advertised his incompetency to deal with the subject in so plain a manner as he did by writing the article mentioned above. His lack of knowledge of the intricacies of railway work could not have been better illustrated, and his regretful expressions that all railway men are not expert accountants, and mechanical and civil engineers, best indicates his lack of knowledge of the men who are managing the great railway systems of this country. The traffic departments are to be congratulated on being exempt from any attack by Mr. Baker. It cannot be denied that they are an able body of men, and it is safe to say that 95 per cent. of the best traffic men of the country obtained their educations in the public schools, and learned the details of their work commencing as bill clerks, and climbing step by step to the positions they are holding today. As an evidence of the eternal fitness of things, it is a truthful statement that railway presidents and general managers in this country are receiving salaries ranging from $15,000 to $50,000 per year, although nine out of ten of them were never educated in any special line, but have a broad and general education, which they have obtained, not through the universities, but in their long journey from the lowest positions on the road to the high ones which they now occupy. Civil and mechanical engineers and expert accountants are a necessity, and railways could not be operated without them. They are especially valuable in their own particular line, but in most cases have not had an opportunity to become proficient in the varied forms of work pertaining to railway operation to anywhere near the same degree as the man who has absorbed his knowledge through contact with the actual conditions. The reference to the situation that has existed in the past on the Pennsylvania and Illinois Central has no connection, and cannot be applied to the case in question, and were Mr. Baker permitted to enjoy the acquaintanceship of 90 per cent. of the railway men of this country who hold important positions, he would be greatly surprised at their ability in handling figures and computing costs.

The gentlemen who gave testimony before the Interstate Commerce Commission are among the highest types of manufacturers, and undoubtedly were sincere and well meaning in their statements. It is safe to say that none of them have had actual experience in the supervision of railway repair shops, but their work has been largely, if not wholly, confined to the manufacture of one or more standard articles, in the making of which certain men and certain machines were constantly employed in the production of standard parts. It is the easiest matter in the world to increase the output of a manufacturing plant by the introduction of the newest and most improved methods and machine tools, high speed steel, and sufficient power to drive the machines to their utmost capacity. In the average railway shop there is a constant change of the work and readjustment of the machines. Often these changes take place many times during the day. It is a condition that operates against a large output, but at the same time is one that cannot be avoided, and which must be met. Undoubtedly if the witnesses were to change from their present businesses and enter the field of locomotive and car repairs, they would in a short time beg the privilege of correcting the testimony given before the Interstate Commerce Commission.

L. H. TURNER,
Superintendent Motive Power, Pittsburgh & Lake Erie.

NEW YORK, January 17, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your issue of January 6, 1911, appears a severe criticism of efficiency engineers. The spot light is turned on their mistakes, and special attention is paid to the extravagant statements and claims made by them. The criticism is supposedly written by "One Who Has Worked With Them." After reading the article the question immediately arose—did the writer work with them or simply along side of them? The nature of the criticism leads one to believe that it was *along side of* rather than *with*. Had he worked with them he would have known with how much care and thought the statements are prepared and would also realize that statements which may appear extravagant to the uninitiated are really sound.

The efficiency engineer determines what can be done with a shop or organization in the same way that an assayer determines the value of a mine. If the plant is a large one the engineer will take several assistants, each of whom will make assays or observations of work in which he has specialized. For example, in a large plant examined by Mr. Emerson, one man observed machine tool operations, another foundry operations, a third power, belting, lighting, abrasive wheels, etc., a fourth the routing of the work, trucking, etc., while Mr. Emerson studied the organization and the accounts. Various inefficiencies were noted such as a planer overrunning the stroke 50 per cent., belts too light and too loose to drive the tools to their maximum capacity, chipping by hand instead of using air hammers, no standard tools but each machinist going to the forge to direct the making of his tools, work poorly routed thus causing excessive trucking, poor discipline, no adequate records, no standards of operations, etc. These assays were all summed up and the plant found to be 40 per cent. efficient. In order to be conservative the saving to be made was based on an efficiency of 60 per cent., and an attainable efficiency of 90 per cent. All statements were made with the same care and conservatism, yet many were called extravagant or visionary. Mr. Emerson has always showed the honesty of his convictions by offering to undertake contracts on a contingent fee. On one railway where an offer was made to reduce the cost of maintaining locomotives 25 per cent., the reply was made that it could not be done and that if it could be done the road would do it itself. A comparison of some of the accounts from this road with those from another road operating in the same territory and under practically the same conditions will immediately show that the statement was not extravagant.

	A. R. R.	B. R. R.
Per cent. operating expenses to gross earnings	77	58
Miles per locomotive	20,500	30,500
Miles per passenger locomotive	28,000	34,000
Miles per freight locomotive	18,000	24,500
Per cent. maintenance equipment to gross earnings	22.4	15.2
Cost of maintaining equipment per locomotive mile	$0.34	$0.245
Cost of maintaining equipment per 1,000 ton miles	$1.95	$1.50
Per cent. maintenance of locomotives to gross earnings	11.37	3.9
Cost of maintaining locomotives per locomotive mile	$0.172	$0.064
Cost of maintaining locomotives per locomotive	$3,500.00	$1,950.00
Cost of fuel per locomotive mile	$0.13	$0.098
Per cent. of revenue tons of freight per loaded car to average capacity	28.5	35.0

The figures reveal other inefficiencies than the high cost of maintaining locomotives.

The criticism seems to consider that the only deterioration on a railway is physical, and therefore a deterioration of 50 per cent. is unreasonable. Consider engines, roadway, cars and crews 100 per cent. efficient, but the cars loaded only to 25 per cent. of their capacity and the despatchers only 50 per cent. efficient, what will be the efficiency of the road? It is not at all uncommon to see solid trains of empty cars going in both directions. For a train to run six hours and stand eight hours in making a division of 100 miles is so common as to be more nearly the rule than the exception. On the last trip which I made on a freight train we stood in the yard for three hours after the time called for starting. On one great transcontinental road (not the Santa Fe) every siding on one 115 mile division is several feet lower than the main line, and the tonnage of the locomotives is determined by what they can pull out of the sidings, not by what they can pull over the division. Examples of railway inefficiencies are so numerous as to make Mr. Emerson's figures appear conservative to one who has studied the conditions.

The editorial in the same issue must have been written with the idea of drawing comment. While, of course, all believe

that no railway official would spend a cent of the company's money except according to his best judgment, still his judgment may be bad for lack of adequate records, competent counsel, and standards. Shops have been built and equipped which impose enormous and unwarranted burden charges on operations. These mistakes are probably due to lack of adequate records and competent counsel. The records are so kept on most railways that the actual cost of any particular article cannot be determined and no one knows whether it is cheaper to buy or to manufacture it.

Mr. Emerson will frankly admit that many of the ideas which he used came from other roads. In fact, while in the employ of the Santa Fe, I made a trip to nine of the leading railway shops to pick up ideas for improvements. Many of the ideas that I brought back are still in use at Topeka. One of the duties of an efficiency engineer is to keep his eyes open for ideas so that he may not have to laboriously work out problems that have already been solved.

The editor must have failed to see the saving on the Santa Fe by looking at the annual reports. The totals do not show it for the reason that the money saved in the mechanical department was spent by others. A little inside history will also explain some things.

During the entire three years Mr. Emerson was with the Santa Fe he was opposed by the superintendent of motive power, who was bitterly antagonistic to the efficiency work. Bearing these facts in mind examine a few of the figures which are taken from statistics prepared by order of the Interstate Commerce Commission for use in its investigation in regard to freight rate advances.

	1904.	1905.	1906.	1907.	1908.	1909.	1910.
Total operating revenue	$54,714,717	$58,802,410	$67,119,993	$75,792,605	$75,574,382	$76,770,668	$86,971,313
Ratio total operating expense (not including taxes) to total operating revenue	60.01	64.50	59.46	60.36	63.49	59.11	64.32
Maintenance of equipment	$7,884,280	$9,331,124	$9,088,085	$9,752,564	$11,786,218	$11,427,226	$12,884,898
Ratio maintenance of equipment to total operating revenue	14.41	15.87	13.54	12.87	15.60	14.89	14.82
Operating expense for repairs and renewals per locomotive mile	10.88c.	12.60c.	9.67c.	9.29c.	11.52c.	9.61c.	10.75c.
Operating expense for repairs and renewals per passenger-train car mile	.78c.	1.23c.	.77c.	.89c.	.90c.	1.05c.	1.23c.
Operating expense for repairs and renewals per freight-train car mile	.63c.	.66c.	.73c.	1.00c.	.75c.	.88c.	.71c.
Fuel for locomotives	$3,968,841	$3,722,231	$4,090,362	$4,484,293	$4,716,497	$4,615,688	$6,210,987
Fuel for locomotives per train mile	16.01c	14.20c.	14.16c.	14.58c.	15.33c.	15.34c.	18.06c.
Ratio of maintenance of equipment to conducting transportation	48.71	54.20	47.91	44.36	50.01	51.29	47.56

The figures not only show that a saving was made during the fiscal years 1906 and 1907 when Mr. Emerson was allowed to install efficiency methods, but also that most of the saving was lost the following year when he left the road and those opposed to the work endeavored to discredit it by increasing expenses.

As Mr. Emerson did more work at Topeka than at any other point, statistics from the Topeka shops are interesting.

Cost of Repairs to Locomotives at Topeka Shops.

	1905.	1906.	1907.	1908.	1909.
Labor	$977.81	$797.52	$817.44	$1,015.00	$1,070.00
Material	779.53	647.18	829.62	1,025.00	1,000.00
Number of locomotives	342	350	357	275	...
Average days in shop	32	26	27	38	38

There were 22½ per cent. more general and heavy repairs in 1907 than 1906. Here again is seen the rise in 1908 and 1909. A system account which illustrates the work on the Santa Fe is that known as the tool account.

Maintenance of Shop Machinery and Tools.

	Fiscal years ending June 30.			
	1905.	1906.	1907.	1908.
Percentage to gross earnings	0.71	0.47	0.34	0.32
Cost per 1,000 locomotive miles	$12.00	$8.20	$6.16	$5.80
Cost per 1,000 revenue ton miles	$0.101	$0.0615	$0.042	$0.041
Percentage to maint. of equipment	4.45	3.45	2.65	2.00
Percentage to maint. of locomotives	9.6	9.4	6.8	5.0
Cost per locomotive	$334.68	$225.03	$176.35	$157.11

In this case there was no loss in efficiency in 1908 as the tool account was still in the hands of the man who had handled it during the three previous years.

Railway accounts are exceedingly difficult to analyze and interpret. Comparisons between different roads are not only hard to make but are dangerous in the hands of the inexperienced. Expenditures which would be economical on one road would be wasteful on another. I hope to present in the near future an exhaustive analysis of railway accounts and believe that it will justify many of the statements of the efficiency engineers.

C. J. MORRISON.

52 East 19th street.

[EDITOR'S NOTE.—Mr. Morrison is a graduate of Cornell University, served two or three years as a special apprentice in the mechanical department of the Northern Pacific and was on the Santa Fe during the time that Mr. Emerson was connected with that road and was on his staff. Since leaving the Santa Fe in 1909 he has been engaged as a consulting engineer in New York.]

"One Who Has Worked with Them" wishes to have it understood that the mistakes credited by him to the efficiency men have come to his attention either directly or on the best of authority during a number of years close work with them and those who were following their leadership. During a large part of that period he defended them against similar charges of extravagance in statement and other criticisms, even as Mr. Morrison now comes to their rescue.

No question was raised in the article to which Mr. Morrison takes exception, with reference to the accuracy of the information secured by the efficiency men through investigations, or assays as he calls them, of conditions existing in specific shops or on certain railways. This question was not considered, and it may be taken for granted for the purpose of this discussion, that such data are usually as nearly accurate as may be expected under the circumstances. It may be said in passing, however, that many things may either escape the notice of "experts" in their examination of a shop or of a railway property, or may be hidden, if there are reasons from the standpoint of the men on the ground why this should be done. It was clearly stated in the article to which Mr. Morrison refers that in most cases the extravagant claims are "possible of proof." This, however, does not make them any the less extravagant. The writer did assert that claims even though based on facts are often either unwarranted or unnecessary—in either case, that under certain conditions they are better left unsaid. Such claims are general, and as the executive heads of our large industrial corporations and railways are necessarily unfamiliar with every detail of the business which they direct, it is only general statements and conclusions that come to their attention. And when these are carelessly made, or are such as not to appeal to the good sense of the average officer, they usually fail to receive the consideration to which they are entitled. It is because the efficiency engineers have lacked tact and good judgment in approaching men in authority that they have not gained their confidence.

It is not to be wondered at that railways do not readily agree to turn over their properties to efficiency engineers who promise to make radical reductions in cost on a contingent fee, even when there is no good reason for doubting that these results can be accomplished. From the standpoint of the efficiency engineer the experiment would doubtless prove a success. Costs could be reduced for a certain length of time, one year, two years, perhaps three years, and his profits would grow apace. But when all the possible savings have been made and the contractor has reaped the benefits, the railway awakens to find that its equipment is in poor condition, its roadbed not up to standard, its labor discontented, and the operation of its road generally demoralized. Then the real payment for the "economy" is begun; the percentage paid to the efficiency engineer is only

a small part of the cost. Such a road has no one but itself to blame, for in giving carte blanche to a theorist to do as he pleases with its property it should be prepared for the consequences which follow, as the night follows the day. Was not the offer made by Mr. Emerson, to which Mr. Morrison refers, to reduce the cost of maintaining locomotives 25 per cent., in itself an extravagant and unnecessary statement to make? And did it not spoil whatever chance of success he might otherwise have had?

Without appearing to question the correctness of the statistics cited for "A" and "B" roads, it may be doubted if the two roads were being operated under the same conditions. It is neither necessary to defend the high costs in respect to "B" nor wise to commend the low costs in respect to "A" without more complete information concerning them. A good record may speedily change to a poor one, and the positions of the two may be altered. Granting, however, that the instances cited are fair, it does not appear that "A" made a good showing because of the adoption of a so-called efficiency system, nor does it follow that "B" could have attained to "A's" record had the efficiency man been called in. The claim has not been made by the writer that certain roads are not inefficient. We agree with Mr. Morrison that there is room for much improvement on many of them; we disagree, however, as to what physician should be called in to treat the patient.

As to deterioration on a road other than physical, this also is recognized. No attempt was made to mention all the factors, out of consideration to the efficiency men. Had they all been considered, the conclusion would have been even more to their disadvantage. It may be said, however, that it is seriously to be doubted if a combination of 100 per cent. engines, crews, roadway and cars with but 25 per cent, car loading and 50 per cent. despatching exists. A railway manager who gets 100 per cent. from the first hour would assurely not be contented with 25 and 50 per cent. from the last two. The poor operating results referred to on a certain road due to delayed trains, sidings being too low, etc., are unfortunately only too common. Railways are looking for relief from the conditions that now make them unavoidable. Their enumeration, however, in connection with this discussion has no bearing upon the question under consideration.

"ONE WHO HAS WORKED WITH THEM."

NEW BOOKS.

Rules and Formulae Relating to Boiler Inspection and Design. Endorsed, adopted and published by the International Master Boiler Makers' Association. Office of the secretary, 95 Liberty street, New York. 65 pages; 3¾ in. by 5¾ in.; flexible linen; price $1.00.

There is a growing need for a good pocket manual relating to that portion of the boiler design which is of especial interest to inspectors and those engaged in the maintenance and repair of boilers, and the present volume is the first attempt to meet this need. There is little, if any, original matter, and the rules and suggestions were selected from various authorities, by a committee of the above association. A special study was made of the staying of flat surfaces by screw stays with riveted heads. This subject is fully covered and the approximate rule of D. K. Clark is given preference. The first 15 pages are devoted to instructions in regard to general inspection of boilers, covering the subject fully and in good shape. The other portion of the book, relating to rules and formulae, is not so satisfactory, because there are no drawings. The rules in regard to the efficiency of riveted joints, reinforced rings, etc., are apt to be confused unless they are accompanied by a sketch showing exactly what is meant by the different dimensions. The book would be materially improved in another edition if it were more fully illustrated. On account of the large amount of inspection of boilers now required by state laws, it is desirable that uniform rules which are authoritative be compiled in good shape and made into a convenient handbook.

INCREASING THE OUTPUT OF A LOCOMOTIVE REPAIR SHOP.*

BY H. HOLDER.

General Foreman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.

The following methods have helped materially to increase the output of our shop about 30 per cent.; this, with working hours reduced and a small increase in the number of machine tools and men. To increase the output of a locomotive repair shop, it is necessary to take a general and impartial view of the entire situation. Each department should then be analyzed in detail. Of course, it is possible for a shop to reach the limit of its capacity beyond which it is impossible to go, owing to insufficient buildings, etc., but it is not intended to deal with that problem.

If, after carefully studying the problem and conferring with the heads of all departments, it is evident that the shop is not working to its capacity, the first step is to find which department is lagging. As the erecting shop starts and completes the work, it is the proper place to begin the investigation, as it has to depend on others for the material with which to work. If the work is furnished by the machine and smith shops before it can be used, and this finished work lies waiting for erecting men, is it the fault of the men, the foreman, or the method of doing the work? If the men are idling or killing time the trouble is with the foreman, and he should rectify it. Our experience has been that if the material is furnished the erecting shop the men will hustle to get it out of the way and up to the next man. On the other hand, if the men are working hard and keeping busy, is it the lack of tools that is holding the work back, and if so, what tools are needed—shop kinks, handy tools, or pneumatic tools? If the former, get busy and make some, as most of them may be made easily and quickly. If pneumatic tools are needed, get in a request for them without delay. If the necessary tools are in service, could the work not be handled quicker if more of it was specialized, such as link and motion work, shoes and wedges, cab mountings, engine trucks, driving boxes, brake work, valve and steam-chest work, rods, guides, etc.? From experience we have found by specializing these different classes of work that much more can be accomplished with fewer men. If all the work is specialized as far as practicable, it is then only a question of a few more men, but on the other hand if the erecting men are continually waiting for work, and have not enough to keep them busy, look to the machine side next.

Is the machine work in general being held back, or is it one or two special jobs such as the pistons and cross-heads, air-pumps, lubricators and injectors, rods, driving boxes, drill-press work, lathe work or planer work? If it is one or more of these special jobs, it is easily located and remedied. If it is the general work, is the trouble with the foreman, the tools or the want of jigs and special tools and kinks? Are some of the machines swamped with work, while others are scantily supplied? Is the work handled to the best advantage by the machines to which it is given, or could it be handled better by others. Then look to the foreman to rectify it. If this is properly handled are the tools equipped with high-speed steel, and operated at the proper speeds and feeds? Our own experience has been, that even old-style planers can be run at three times their original speed and by making special tool holders for high-speed steel; the feed can be increased in the same proportion and do better work than before.

Is the stock of finished material kept up? If not, the work will surely fall behind, for if the stock runs out and a machine has to stop, and be changed to make one or two small pieces which should be made by the hundred instead of singly, the output of that machine will be retarded 50 per cent. or 75 per cent.

The machines should be grouped to handle the different classes of work to the best advantage without too much trucking. The

*Submitted in the competition which closed December 15, 1910.

piston and cross-head machines should be near where the bench work is done. The machines doing driving box work should be close together, including the babbiting of hub faces, pressing in the brasses, machining the outside of the brasses, fitting boxes and boring.

Are the machines supplied with rough material from the smith shop, storehouse and foundry in ample time for machining and delivering it to the erecting shop in time for completion of the engine on schedule time? If not, does the hand-forged work from the smith shop cause the delay, and if so, could not dies be made for forging the pieces in quantity under a steam hammer or in a forging machine? If forging machines are not kept busy from Monday to Saturday, could not dies be made to do much of the work now done by hand?

It may be that work is delayed and material left in the fire to soak, while waiting for a helper from another fire, or for a chance to get the use of the steam hammer. One or two more helpers, or one more hammer would help the situation wonderfully.

The boiler work should always be ahead of the erecting work two or three days, for if not, it will surely hold the engine back and retard the output. If behind time it should be given special attention at once, so that as soon as the engine is wheeled the ash-pan can be put up, and the engine be ready for steam in 8 to 10 hours. If this cannot be done because of ash pan work interfering with the erecting men in the pit, owing to engines having underhung springs, etc., it would pay if the shop is large enough to have one ash-pan crew work nights. With the boiler work, front end, and ash pans out of the way, engines can be turned out of the shop from two to three days sooner than otherwise. In our own shop, under these circumstances, we have wheeled an engine at 7 a. m., and have had it on the road under steam at 3 p. m.

Last, but not least, does the store keep in stock the material most needed, and supply it quickly? If not, what is the reason? Is the storekeeper informed as to the shop's needs, or is he expected to guess at them? A lot of material may be in stock that was usable years before, but is now out of date. The storekeeper is not aware of it, and his old stock should be used wherever possible, even at a loss, for the sake of getting rid of it, thereby getting it off his hands and making room for more up-to-date and useful material. He should be told what is wanted and be given an idea of the quantity desired. He should also be aided in reducing the stock by combining several different sizes of the parts (where the difference is slight) into one, and thereby keep 12 pieces of one size in stock, instead of 48 pieces of 12 sizes. This is better for the shop, as well as for the store, for it gives a much larger stock, as far as the shop is concerned, but a much smaller stock in the store. This may be done with axles, piston rods, crank pins, sheet steel, and innumerable castings of iron, brass and steel. This will put the proper kind of stock where it can be delivered almost at a moment's notice, which every foreman knows to be a great advantage. Where it is necessary to wait from two days to four weeks to get the rough material, the finished article must necessarily be held back.

Just a word as to the foremen. Are they all working in harmony as they should, and in good natured rivalry to keep their own department ahead of the others? If not, they should mend their ways at once, and all work together for the good of the whole. The foreman must set a right example for his men, for few workmen will go beyond the pace set for them by their leader. If he goes about his work with a "What we don't do today we can do to morrow," kind of an air, the workmen will do likewise. He should be able to read human nature and to get the best results he must keep the good-will of all those under him. Be one with the men and still above them, and treat everyone fair and square, without partiality. A live, wide-awake, up-to-date foreman, will see that as soon as the work is handed to him, it is started on at once and forwarded to the next department as quickly as possible.

ELECTRIFICATION OF THE SHOPS OF THE WABASH RAILROAD.

Many of the older and smaller railway repair shops are still operated at a large expense for power transmitted by shafting from steam engines. In some cases this involves the maintenance of two or three boiler plants and engines, with firemen and engineers at each plant. At other old repair shops new power plants have been built at a large expense and the machinery entirely changed for the electric drive. The large cost of the electric drive where a new power plant is contemplated has often prevented the desired improvement, but that it is possible to make considerable improvement at a moderate cost is shown by the practice of the Wabash. The new car shops of this road at Decatur, Ill., were provided with an electric power plant which has additional capacity sufficient for the locomotive terminal some distance away. At Moberly, Mo., several small boilers and engines at the shops and the pump house were replaced at comparatively small expense by one station with a 150-k.w. generator for shop tools, light and pumping. A description of the installation was published in the *Railway Age Gazette*, November 20, 1908. A similar installation has been made at the Wabash shops at Fort Wayne, Ind., and Springfield, Ill.

At Springfield the power is furnished by outside parties and is delivered at 2,300 volts. It is transformed by Westinghouse oil type transformers to 440 volts for power purposes and 110 volts for lighting. Westinghouse oil type circuit breakers are used at the switchboard on both the power and lighting circuit, and in addition there are three-pole, single throw, no arc, fused knife switches protecting each circuit. All wiring is in conduits. The main machine shop and the erecting shop have six motors as follows: Two 35-h.p., one 25-h.p., one 20-h.p., and one 15-h.p. driving the machine tools and one 25-h.p. motor on the drop table. The tools in the machine shop annex are driven by a single 20-h.p. motor. A 7½-h.p. motor is used for driving the carpenter shop and a 20-h.p. motor in the boiler and blacksmith shop. For furnishing blast for the boiler and smith shops a 35-h.p. motor is used direct connected to a 12-in. fan. All motors, with the exception of the one operating the drop table are of the three-phase 440 volt, 60 cycle, a.c., induction or squirrel cage type. The drop table motor is a slip ring type with a reversible controller which furnishes variable speed from 850 to 1,140 r.p.m.

Power is furnished by the Springfield Heat, Light & Power Company, which brought the power wires to a convenient point in the shop yard and installed a transformer at its own expense. The aggregate power of the ten motors is 177½-h.p., and the cost of the installation was as follows: Ten motors, $2,838; pulleys and belts, $264.54; switches, $70.55; conduit and wire, $332.64; switchboard, $82.59; sundries, $163.49; labor, $350; total, $4,101.81. The estimated cost of the transformer furnished by the power company was $350.

LARGE LOCOMOTIVE MILEAGE.

The *Santa Fe Employees' Magazine* for January, 1911, publishes the following record for engine No. 1415, a 4-cylinder balanced compound, which was received from the Baldwin Locomotive Works in April, 1906, and went into service on May 1 of that year on the first district of the Albuquerque division. On October 22, 1910, four years and five months later, the engine was sent to the shop for the first general repairs after making 241,335 miles. The boiler record was equally good, as during the period no tubes were removed. The engine was in charge of the same engineer and fireman while making this extraordinary record, which is without precedent on the Santa Fe. It was in service in a district of treated water, and before the treating plants were put in it was only possible to obtain from 30,000 to 40,000 miles between tube renewals.

Shop Kinks.

FIRST PRIZE.

BY M. H. WESTBROOK.

Grand Trunk, Battle Creek, Mich.

APPLICATION OF FLEXIBLE STAYBOLTS.

A device for applying flexible staybolts is shown in Figs. 1 and 2. It consists of a sleeve A which screws on the socket B. The

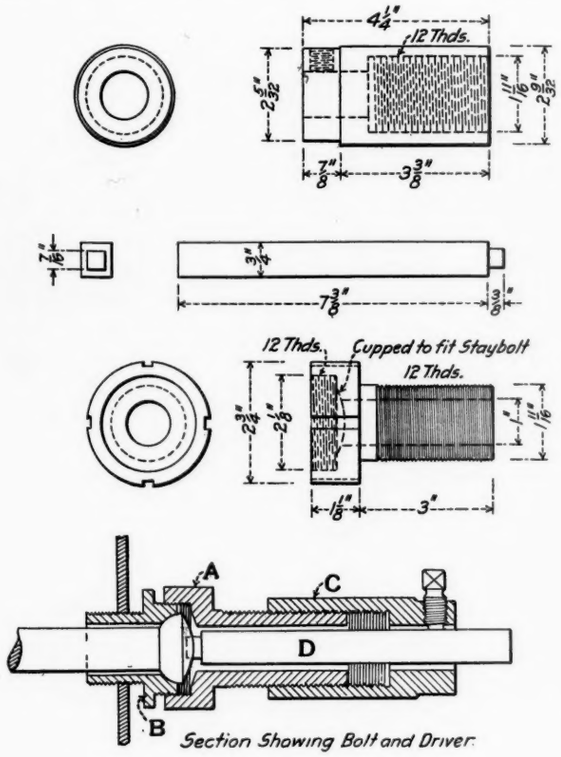


Fig. 1—Driver for Flexible Staybolts.

sleeve C is threaded to the same pitch as the staybolts and holds the end of the square steel driver D in the square recess in the head of the staybolt. The driver D is revolved by a small crank

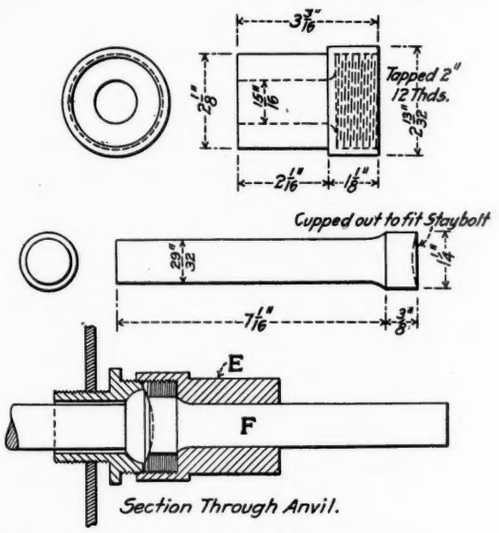


Fig. 2—Anvil for Applying Flexible Staybolts.

which is not shown, making the application of the staybolt a comparatively easy job. After it has been screwed into place, sleeve E, Fig. 2, with anvil F, is applied to hold the head of the bolt while it is being riveted over on the other end.

BORING TOOLS FOR AIR PUMP CYLINDERS AND STEAM CHESTS.

A method of boring air pump cylinders which saves taking them apart, as is sometimes necessary when they are bored out

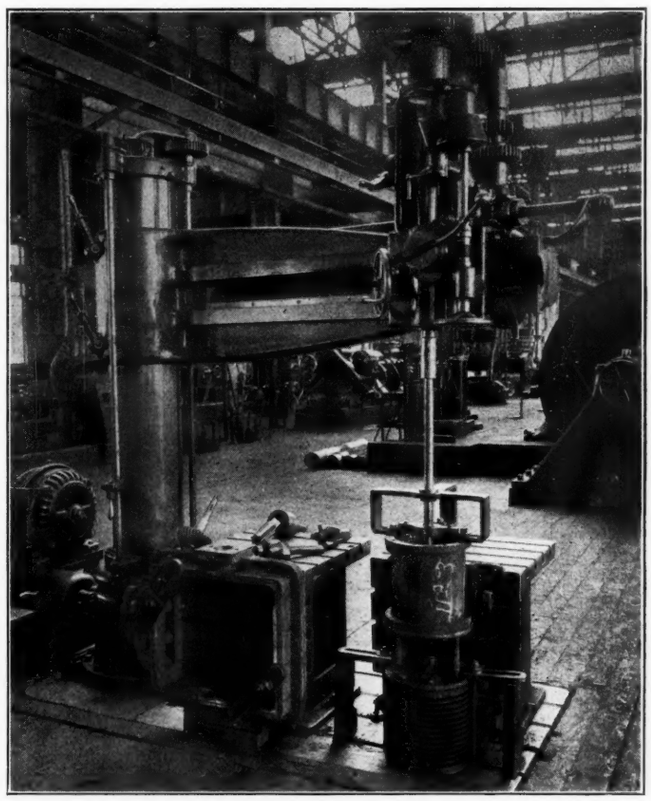


Fig. 3—Tools for Boring Air Pump Cylinders and Steam Chests.

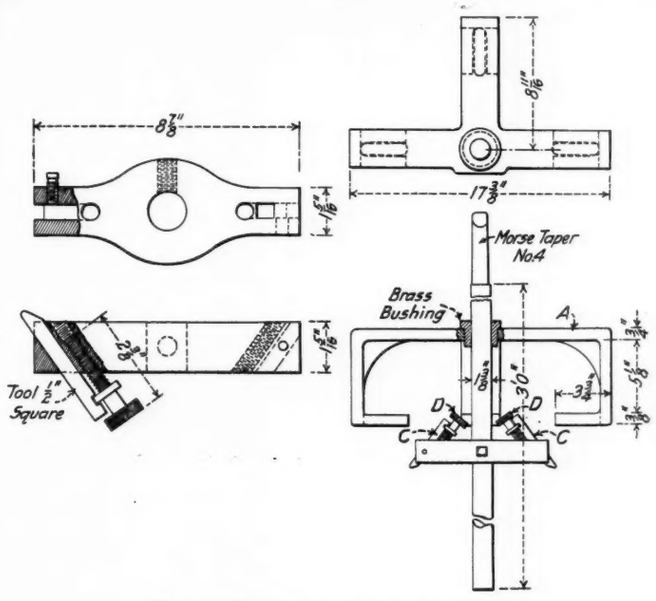


Fig. 4—Boring Tool for Air Pump.

in a lathe or boring mil, is shown in Figs. 3 and 4. It insures a bore perfectly true with the cylinder head bore, as reference

to the drawing will show. The guide bracket A is bolted to the cylinder casting after the spindle has been centered. The tools C are adjusted by the screws D. The boring bar is made with a standard Morse taper shank and is driven by a universal drill.

To the left of the air pump in Fig 3 is shown a steam chest which is ready for boring. It was formerly the practice to cast the steam chest with this hole cored and to finish it on a

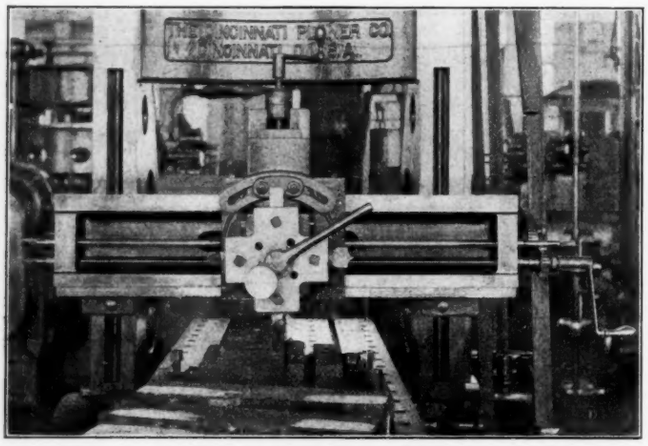


Fig. 5—Turret Tool Head Applied to a Small Planer.

horizontal boring mill, but considerable time was often lost, due to the core having been placed off the center or because of the holes being filled with sand. By making the part solid and using special high speed steel counterboring tools and drills, one of these can be finished in a few minutes.

TURRET TOOL HEAD FOR SMALL PLANER.

The application of an inexpensive turret tool head to a small planer is shown in Figs. 5 and 6. It was primarily made to reduce the time of planing shoes and wedges, there being three tools for each shoe. However, it has since proven adaptable to the general run of work and is a good time and labor saving device. The tool head is bolted to the clapper E and turns on the pin B; it is centered by the pin C and is clamped in position by the hand nut D.

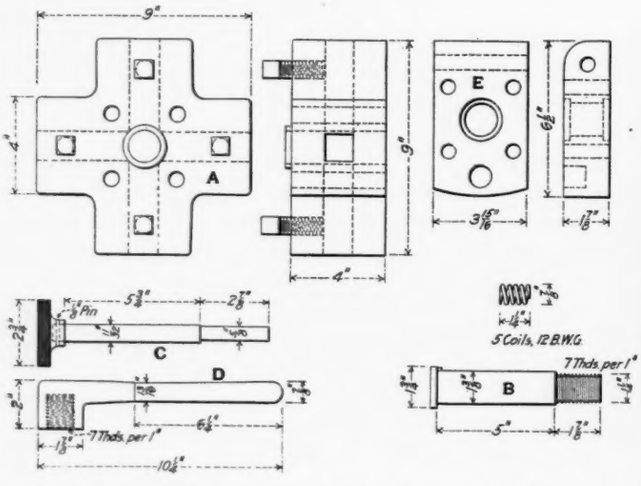


Fig. 6—Details of Turret Tool Head for Planer.

MILLING SHOES AND WEDGES.

A quick and cheap method of machining the inside and outside of shoes or wedges at the same time is shown in Fig. 7, the machine being shown set up for wedges. They are bolted to the cast steel jigs by ¾-in. countersunk head bolts, the nut being placed on the under side of the jig. One bolt is sufficient for each wedge as the ends are securely blocked. The holes can generally be drilled in a place where they may later be used for holding the wedge to the frame jaws. The wedges are blocked up on one end to give the required taper.

SHARPENING MILLING CUTTERS ON THEIR ARBORS.

A method of sharpening milling cutters while on their arbors is shown in Fig. 8. A portable adjustable head carries an emery

Fig. 7—Milling Shoes and Wedges.

wheel which is driven by a belt from an air motor arranged on a suitable frame. This method is considered an improvement over grinding them in the usual way in the tool room, as frequently after severe duty the arbors become slightly sprung, which results in two or three teeth having to do most of the work. In many ways this method has proven superior to the general practice. The portable grinder has been found useful for other purposes.

MULTIPLE PARTING TOOL FOR PISTON RINGS.

A multiple parting tool used on boring mills for making piston packing rings is shown in Fig. 9. A tool is made for each width of ring used, as it takes time to change the spacing blocks for the rings of various widths. When properly adjusted, these tools are used to part the rings to the correct width and no

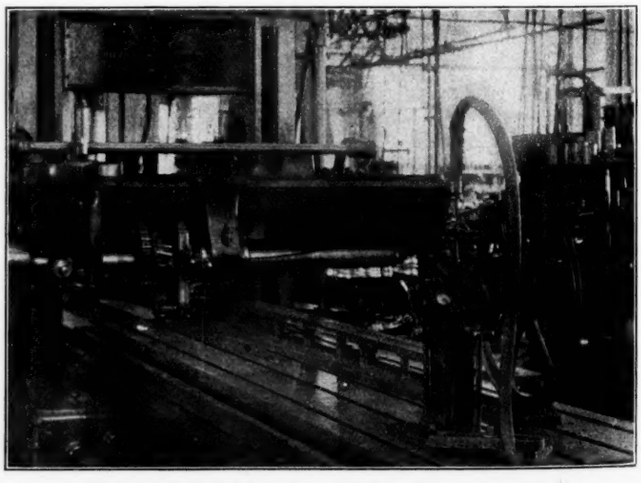


Fig. 8—Sharpening Milling Cutters in Place on Their Arbors.

facing-up is necessary after they are cut off. The drawing shows the tool in detail.

PLANING BABBITTED TRUCK BRASSES.

A tool for planing babbitted bearings of engine truck brasses is shown in Fig. 10, two strokes of the planer or shaper being

sufficient in most cases to make a good bearing. The tool is a disk of a diameter to suit the brasses, 5/8 in. thick, and made of tool steel. It fits the head of a Morton draw cut shaper, but the shank may be made to suit any machine. When dull the cutter may be revolved one-third of the way around, which gives a

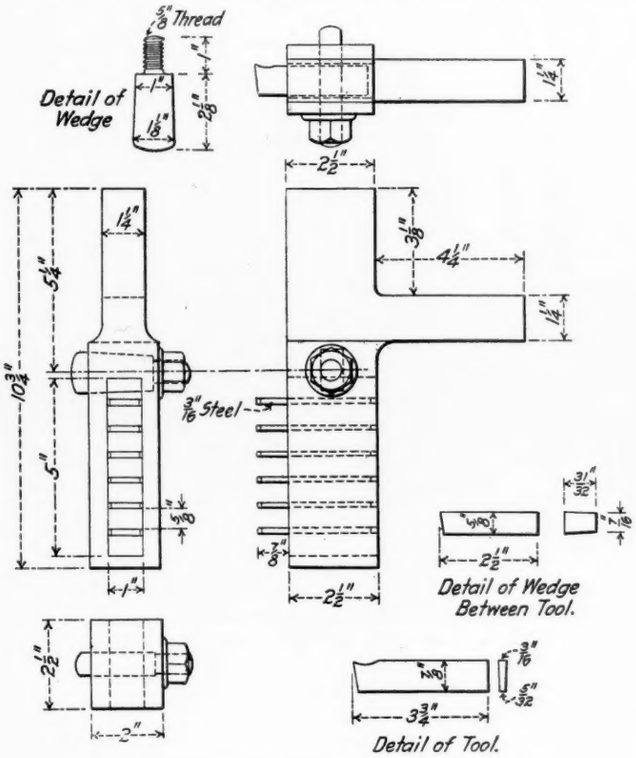


Fig. 9—Multiple Parting Tool for Piston Rings.

new cutting surface; it thus has three cutting surfaces which may be used before resharpening.

SOCKET FOR TAPER REAMERS.

A socket for holding taper reamers is shown in Fig. 11, group A. This has proven of value in reaming main rod ends and straps. The absence of the positive rigidity, found in the solid socket and spindle, allows the holes to be reamed faster and with less breakages.

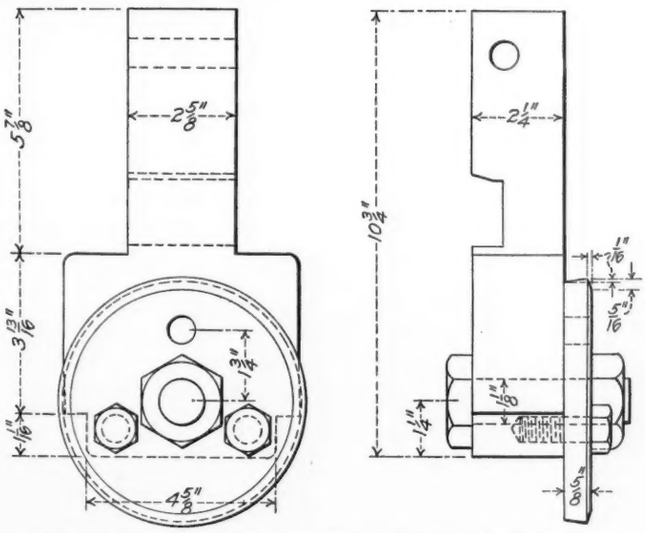


Fig. 10—Tool for Planing Babbitted Truck Brasses.

CENTER GRINDER.

A pneumatic grinder for lathe centers is shown at E and G in Fig. 11, and in Fig. 12. It is made from a rotary air motor

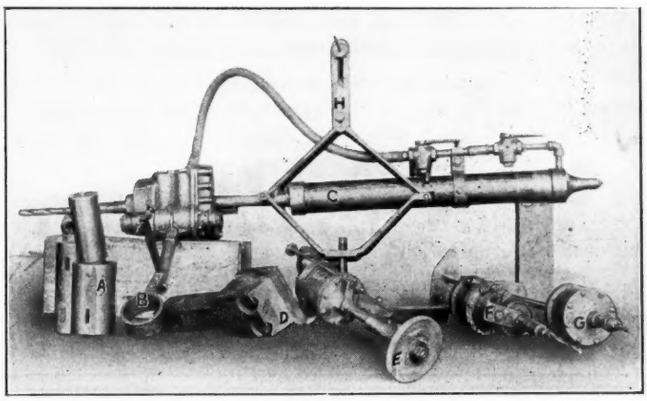


Fig. 11—Miscellaneous Tools and Handy Devices.

originally designed for drilling 3/16 in. tell-tale holes in stay-bolts. It is small and may easily be held in place in the ordinary lathe tool holder.

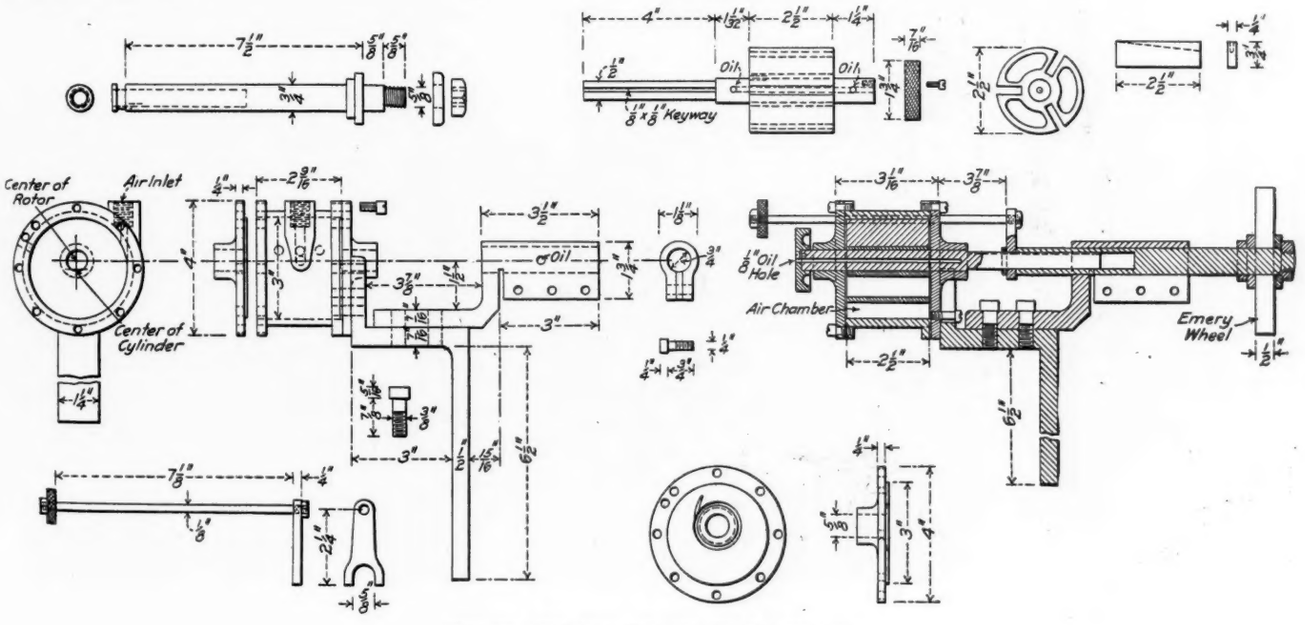


Fig. 12—Details of Lathe Center Grinder.

QUARTERING MACHINE GAGE.

A quartering machine gage, B, is shown in Fig. 11. It is slipped over the spindle and used to true up the crank pin preparatory to boring out the opposite wheel for a new crank pin.

PNEUMATIC FEED FOR AIR MOTORS.

A pneumatic feed, C, for air motors is shown in Fig. 11, and in detail in Fig. 13. It has many uses and is especially adaptable

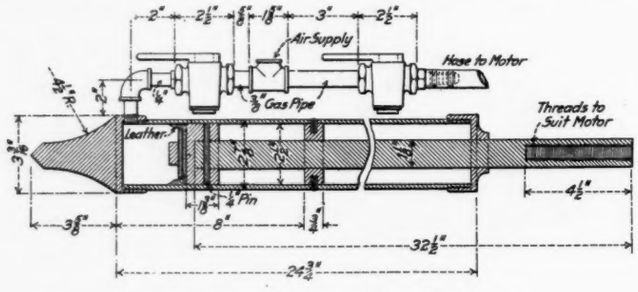


Fig. 13—Pneumatic Feed for Air Motor.

in drilling and tapping driving and truck wheel hubs for hub liners, and in drilling into the heads of tire retaining ring rivets preparatory to removing the ring and replacing the tire. The pressure on the piston gives a constant feeding pressure to the motor.

PLANING BABBITTED CROSSHEAD SHOES.

A tool for planing babbitted crosshead shoes in one cut is shown at D in Fig. 11. It has been made to cut better by having the cutting edges beveled back slightly.

PNEUMATIC BREAST DRILL.

By adding a set of gears to the motor described above, as shown in Fig. 14, a breast drill F in Fig. 11, may be made that will drill holes up to 9/16 in. in diameter.

QUARTERING INDICATOR.

The quartering indicator, H in Fig. 11, has proven valuable when pressing axles into driving wheels that have the crank pins already in.

REAMERS.

Several reamers and shanks are shown in group J, Fig. 15, which illustrate an idea of standardizing the holes in special

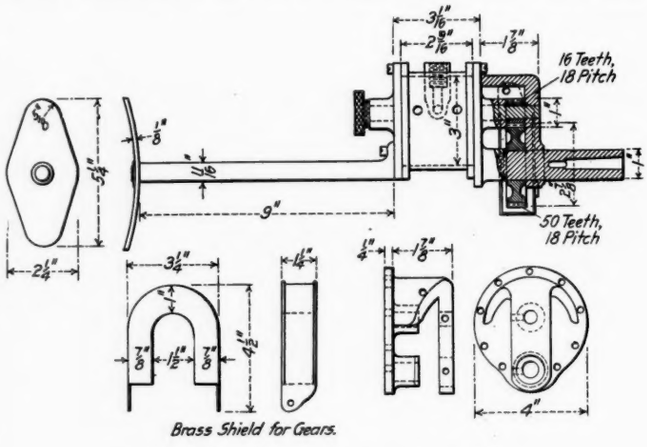


Fig. 14—Pneumatic Breast Drill.

reamers so that spindles or shanks may be made to fit into the various styles of machines that may have occasion to use these reamers.

The reamer on the right of group K, Fig. 15, has been found to be an improvement over the other two as the flutes are not as near together and there is more room for the chips to free themselves and work out of the hole. Under heavy tests this reamer has not broken a flute.

LATHE TOOLS FOR BRASS WORK.

An economical design of lathe tools for brass work is shown in group O, Fig. 15. Each tool has a seat for the set screw located by a jig so that it will fit the shank properly and run true

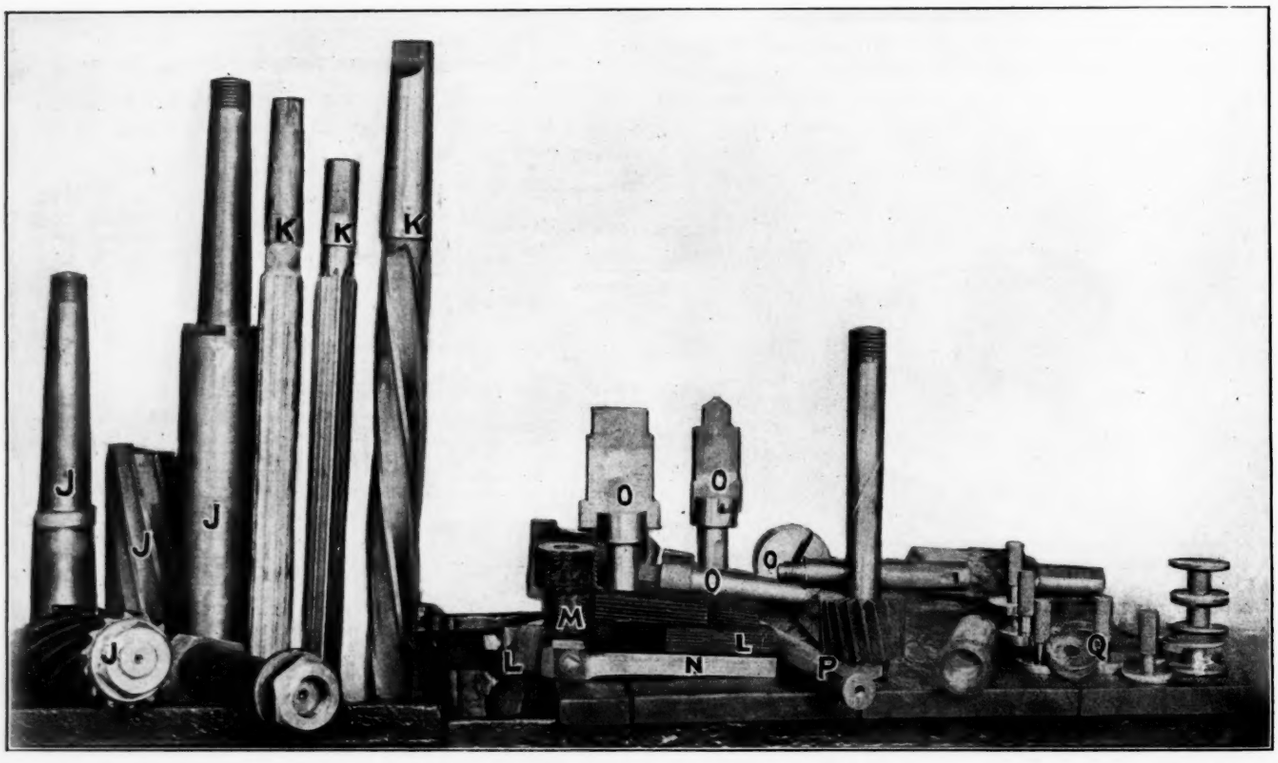


Fig. 15—Miscellaneous Tools and Gages.

with the spindle of the lathe. This is much cheaper and more satisfactory than the solid tools used in some shops.

THREADING TOOL.

A threading tool is shown at N, Fig. 15, and in detail in Fig. 16. It is only necessary to grind the top face to keep it sharp. It is milled by the cutters M, which in turn are made by feeding the chaser L into the cutter in the lathe forming a series of

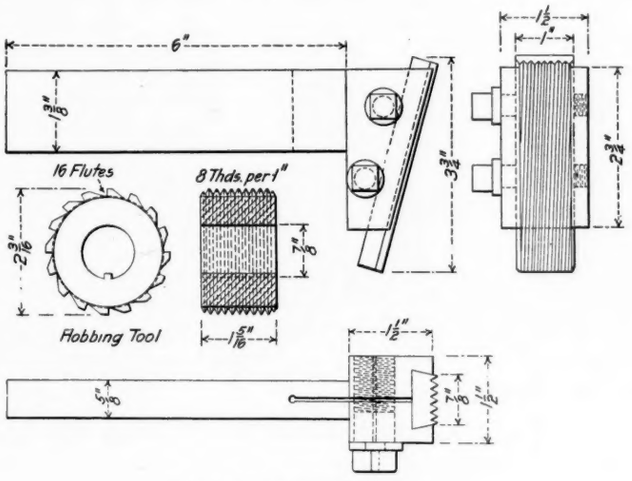


Fig. 16—Threading Tool.

angular grooves of the desired pitch and depth. The cutter N, shown set in the holder, has threaded 14,000 mud plugs and used up 1¼ in. of the cutter.

AIR PUMP GAGES.

A set of piston and ring gages for air pumps and piston packing rings are shown in group Q, Fig. 15. The gages in each set vary by 1/32 in.

SECOND PRIZE.

BY R. G. BENNETT.

Motive Power Inspector, Pennsylvania Railroad, South Pittsburgh Shops, Pittsburgh, Pa.

STEEL CAR REPAIR JACK.

The steel car repair jack shown in Fig. 17 has proved valuable as a time and labor saver in the repair of steel cars. It is built of a number of channels, so arranged as to act as guides and supports for screw jacks which may be used on either the side or top members of the frame. The columns are spaced about 8 ft. apart; they are imbedded in concrete piers, which are 5 ft. deep, and are braced at the top by angle irons and channels. The screw jacks each consist of two bronze nuts which are clamped to the channels by bolts so that it is possible to adjust them to any height. Through these nuts is passed a steel jack screw, outside diameter 2¼ in., with two threads per inch (square threads); on the end of jack screw is a swivel iron head. The damaged car is placed in the structure and the bulged side sheets or underframe, after being heated with a burner, may be jacked back into their proper places and held there until cooled. Eye bolts are placed at the base of the columns so that the cars may be chained to the rail when it is necessary to do so.

BABBITT FURNACE.

The furnace shown in Fig. 18 is used for melting babbitt from the faces of driving boxes and other locomotive parts

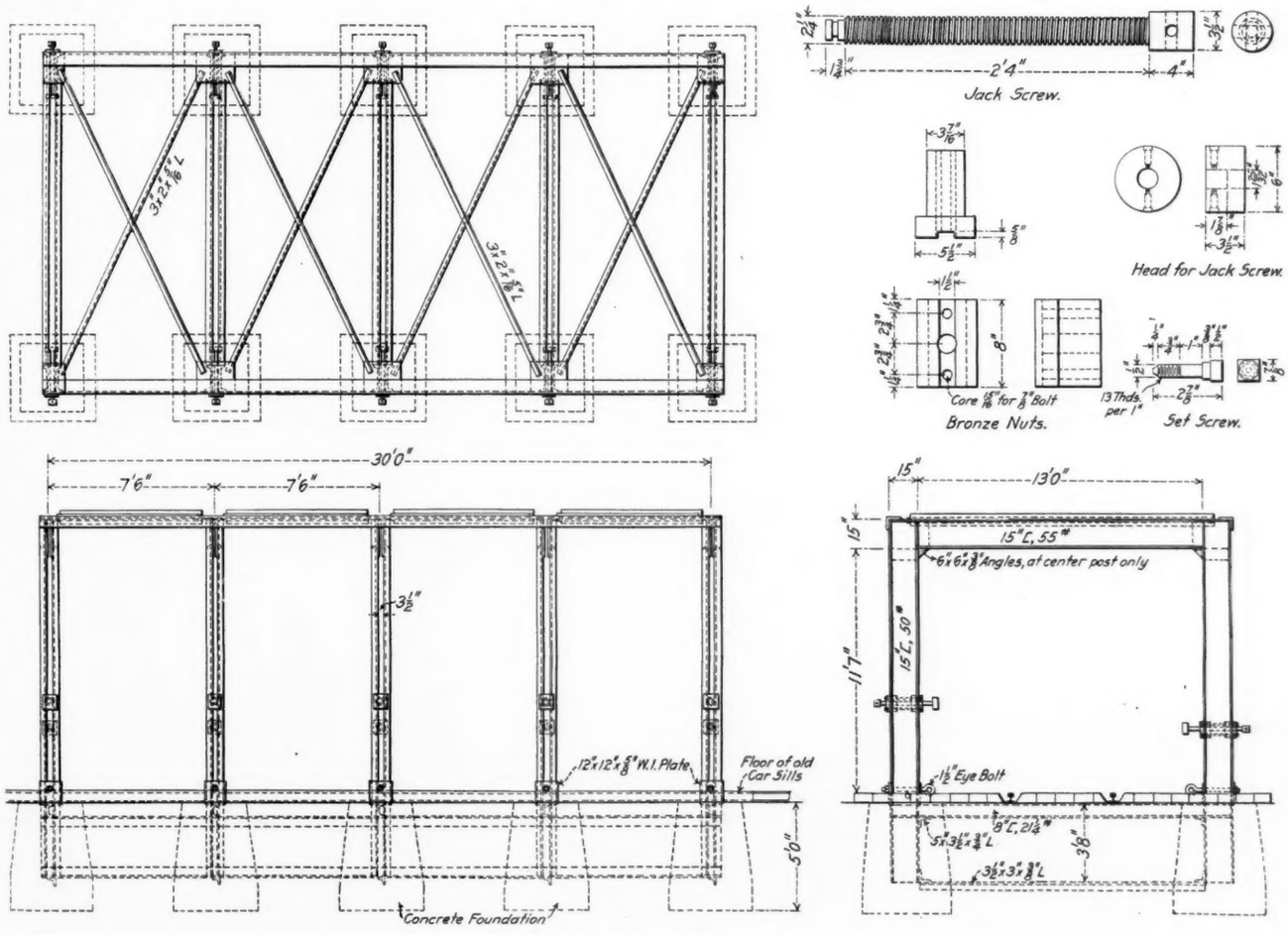


Fig. 17—Steel Car Repair Jack.

that are brought into the shop for repairs. The parts may be hoisted by a wall crane into the cast iron ladle, under which is an 8-in. Good Luck burner. Gas is supplied to the burner through a 3/8-in. pipe and air through a 1/2-in. pipe. The furnace is a sheet iron box lined with fire brick and having a door on one side. This device does away with the machining or chipping off the old babbitt from the box, and the melted babbitt thus obtained may be used again.

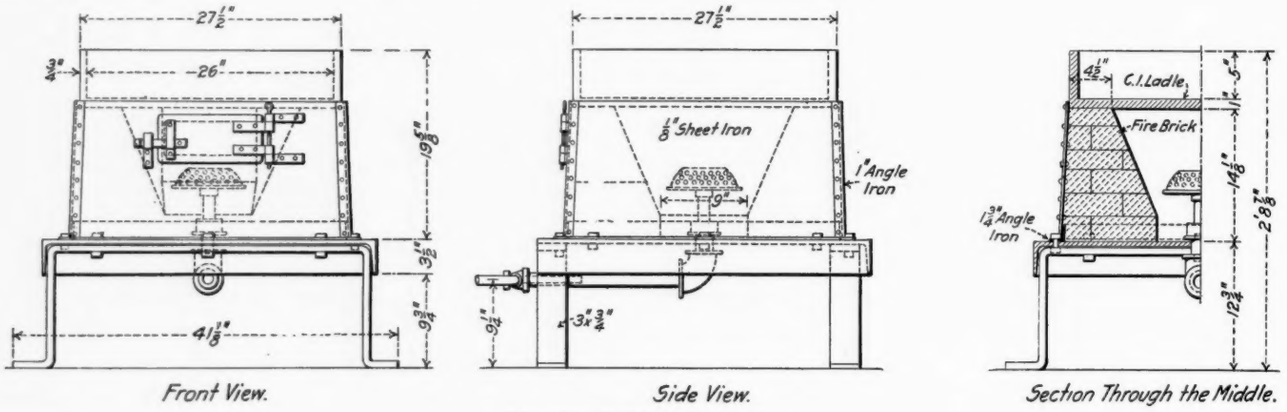


Fig. 18—Babbitt Furnace.

BABBITTING THE FACES OF DRIVING BOXES.

The babbitting jig shown in Fig. 19 affords an easy means for babbitting the faces of driving boxes to any desired thickness. To apply the jig, first fasten the cross piece A to the box by passing the cellar bolts through the holes provided; then force the jig into the top of the journal bearing by means of the screw B. The cover plate C will then extend over the face of the box and may be adjusted by the screw F to give the required thickness of babbitt. The clamp D holds this in a rigid position. The babbitt is poured through the tap holes in the plate and is prevented from flowing away by a gum band E, which extends around the outside of the cover plate, together with a little clay packed around the outside of the gum band. This device has lightened the work on the boring machine on which it was formerly necessary to face off the excess metal.

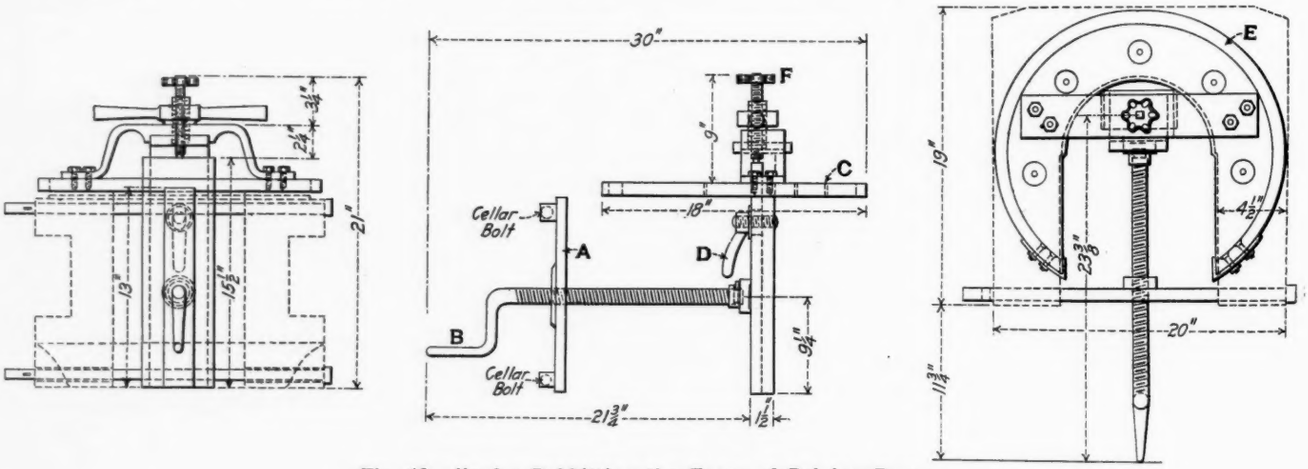


Fig. 19—Jig for Babbitting the Faces of Driving Boxes.

BOLT SHEARING MACHINE.

A serviceable device for a car repair yard is the bolt shearing machine shown in Fig. 20. It consists of a long lever E, pivoted at G, with a knife blade F inserted in it. The lever is operated by a 10-in. air brake cylinder. A piece of iron D, notched to receive 3/4-in., 7/8-in. or 1-in. bolts, is bolted to the crosspiece; when air is supplied to the cylinder the knife will shear the bolt. The whole mechanism is mounted in a wooden frame supsists of a portable rail saw, as manufactured by the Vandyck Churchill Company, so arranged that it may be operated by an air motor connected to shaft A, and fed by hand or automatically by the pawl and feed mechanism shown in the illustration. Two adjustable legs support one end of the machine while the other end is clamped to the locomotive frame.

STRIPPING MACHINE FOR TORN HOSE.

A device for cutting the clamp bolt and removing the fitting from one end of a torn air brake hose is shown in Fig. 22. By means of an 8-in. air brake cylinder and a system of levers, the operator, by pressing a foot-valve, may cut the clamp bolt with the knife A at the left of the machine. After removing the clamp lay the end with the fitting on top of the jaws and again press the foot-valve. The plunger B will force the piece down through the jaws tearing the hose from the fitting. The knife A is driven by a cam attached to the frame of the machine. This machine has been found to be a valuable addition to an air brake hose department.

TRIP HAMMER FOR SHEARING YOKES FROM COUPLERS.

A simple device for shearing yokes from couplers is shown in Figs. 23 and 24. The machine consists of a cast steel hammer, weighing 1,570 lbs., which may be raised to any desired height by means of an 8-in. air cylinder; it is tripped by a tripping attachment coming in contact with a 3/4-in. rod which is passed through two eye bolts fastened to the guides of the hammer.

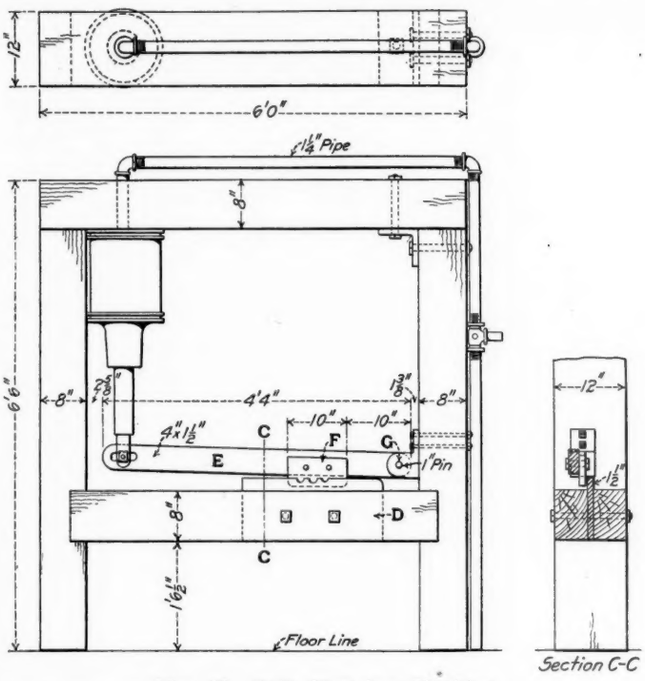


Fig. 20—Bolt Shearing Machine.

The movable block and spring near the top of the guides absorbs the shock of the tripping device as it flies up after releasing the hammer. The drop of the hammer is regulated to 9 ft. in summer and 8 ft. in winter. One blow shears the yoke from the coupler; occasionally a malleable iron coupler is damaged, but never a cast iron one. The time and labor saved by this machine however, compensates for any loss of this kind. The machine may be operated by one man stationed at the cylinder, who, by operating the rod connecting the air cocks A and B, and opening and closing the valve C in the exhaust pipe, may raise and lower the hammer at will. To operate the hammer move the connecting rod to close the valve A and open the valve B, thus admitting air at the top of the cylinder. When the hammer is tripped, move the connecting rod in the opposite direction, which opens valve A and closes valve B at the same time. A hole drilled in the side of valve B permits the upper part of the cylinder to drain, thus relieving the pressure ahead of the piston. Exhaust valve C is used to exhaust the air from the cylinder

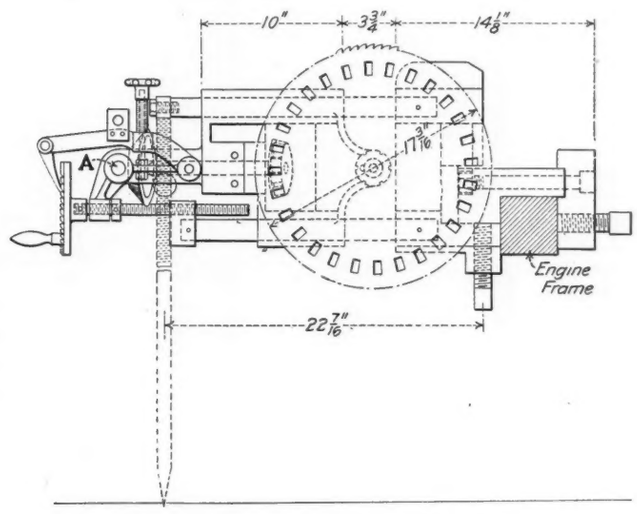


Fig. 21—Locomotive Frame Cold Saw.

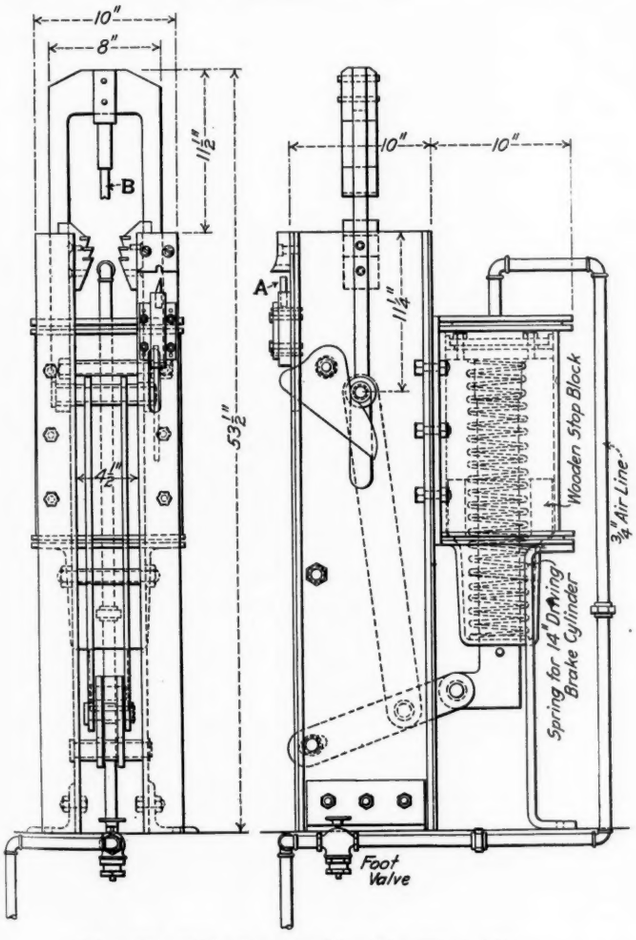


Fig. 22—Stripping Machine for Torn Hose.

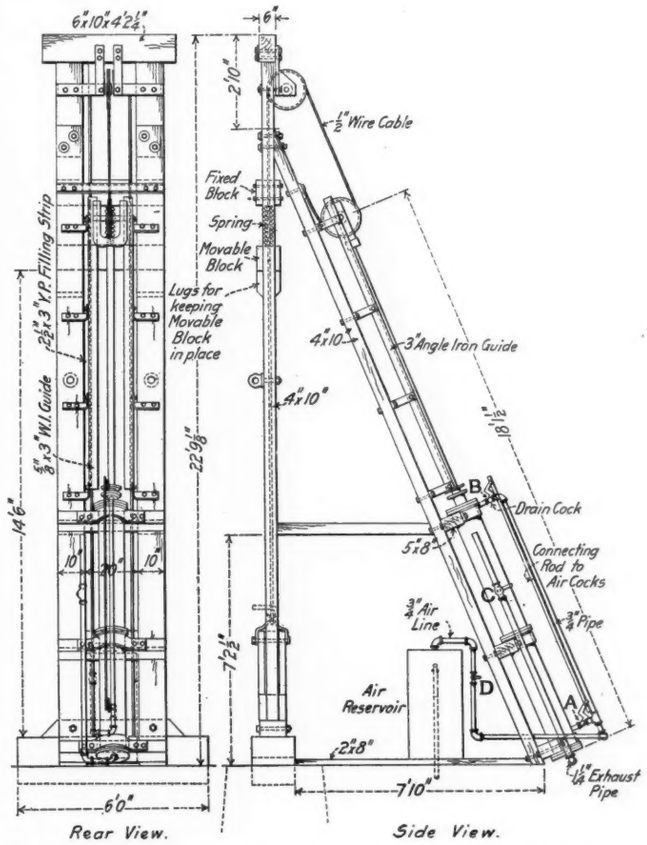


Fig. 23—Trip Hammer for Shearing Yokes from Couplers.

after the piston is moved to the starting position. It is closed when lifting the hammer, to give the required dash-pot action. Air is taken from an air reservoir through the valve D, which should be closed when the machine is out of use. Air is used from the shop line at about 100 lbs. pressure.

Fig. 24 shows a partial front elevation of the lower part and base of the apparatus including the blocks and spring on which the yoke with its coupler is placed for shearing. Before placing the coupler and yoke in the apparatus the hammer is raised slightly and is then lowered until it rests on a movable arm which may be swung under it. The workmen are thus protected from the accidental falling of the weight while they are placing or removing couplers in or out of the device. When air is admitted to the cylinder and the hammer is raised the arm is automatically swung out of the way. This device was first seen at the shops of the Union Railroad.

HOSE STRIPPING MACHINE.

A compact arrangement for stripping the fittings from air brake hose is shown in Fig. 25. The machine is operated by the foot valve B, which admits air to an 8-in. by 12-in. air brake cylinder. The piston rod has fastened to its upper end a forked member C, which when air is admitted to the cylinder rises. In the first operation this end C, forces the knife A over, cutting the clamp bolts so that the clamps may be removed. The piston is then allowed to return to its normal position. In the second operation the forked end when rising, closes the movable clamps F which work on the guides H. The inside faces of these clamps are fitted with checkered plates so as to firmly grasp the hose. Each clamp also has two studs G, at the ends of which are coil springs for the purpose of drawing the clamps back after the air pressure has been released. The links J and K, and the

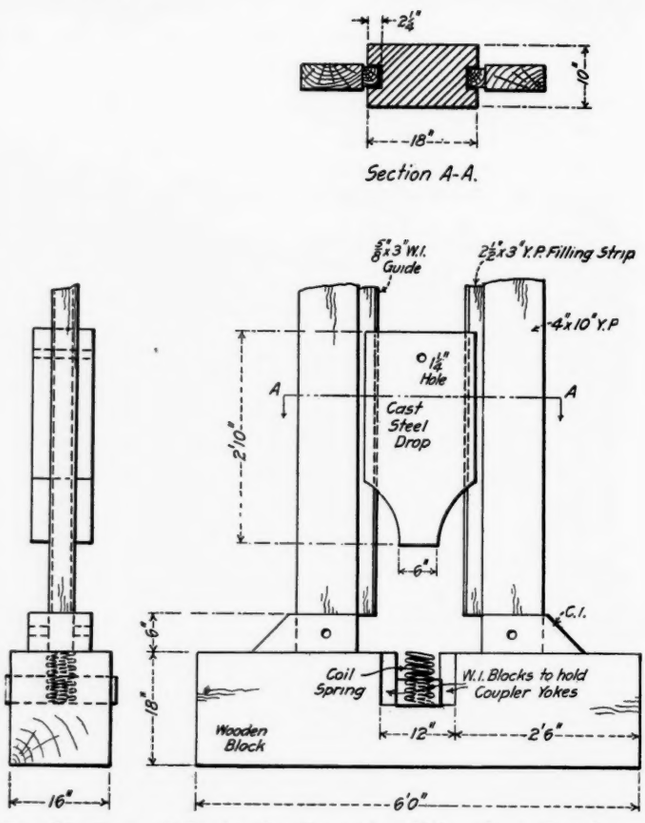


Fig. 24—Base of Device for Removing Yokes from Couplers.

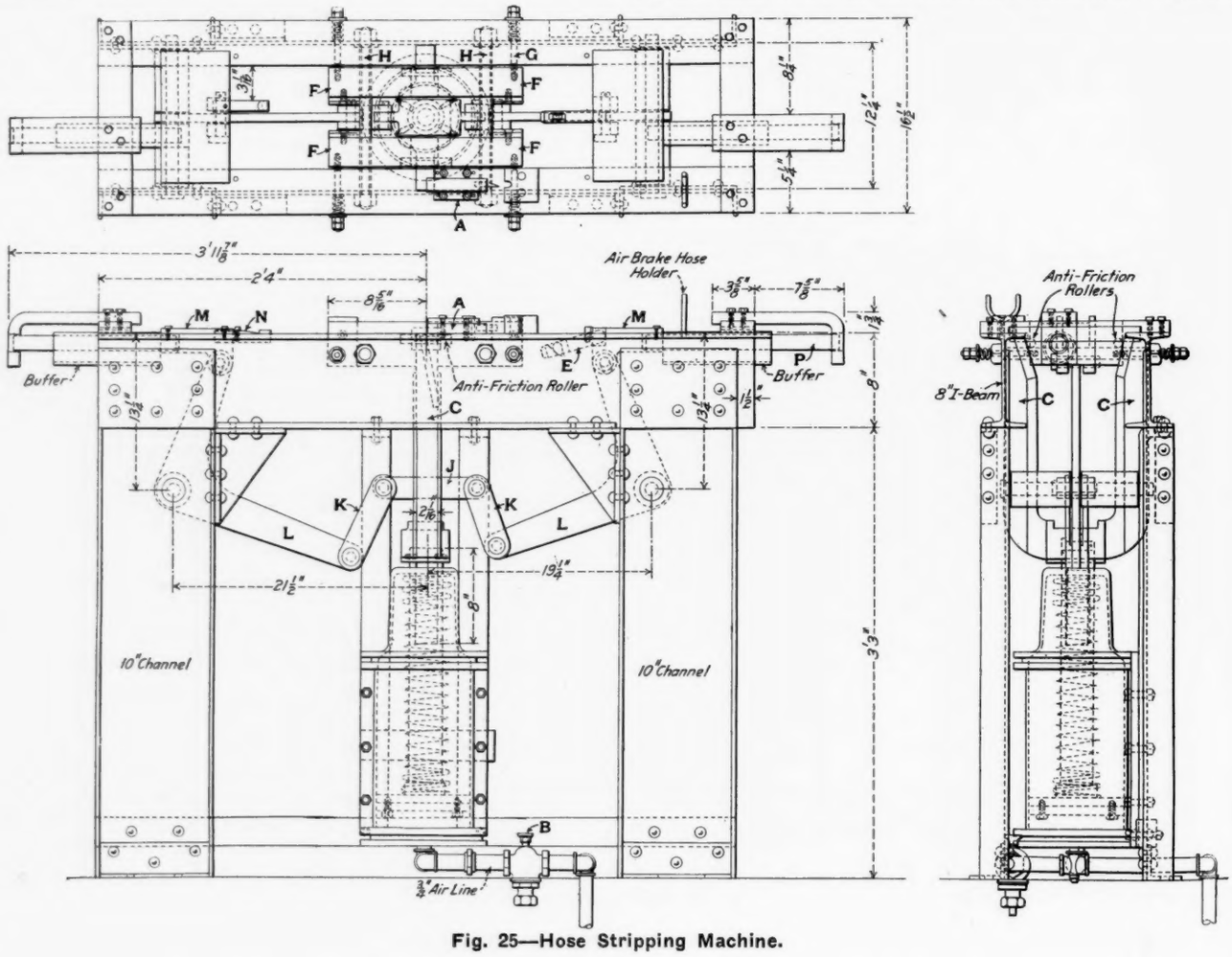


Fig. 25—Hose Stripping Machine.

bell cranks L operate the stripping blocks M. To one of these blocks is attached fitting N to catch the hose coupling, and to the other fitting E to catch the nipple end of the hose. These stripping blocks move along the top face of the machine, using the inside flanges of the I beams which form the bed of the machine as guides. At the end of each stripping block is a rod P which holds a piece of air hose that acts as a buffer and takes up the horizontal shock when the hose is stripped. There is a heavy coil spring in the cylinder to absorb the vertical shock at the moment the stripping takes place. When operating the machine the workman, after removing the clamps, places the hose so that the fittings catch in their respective holding devices. He then operates the foot valve, admitting air and raising the piston. The clamps grasp the hose and the fittings are drawn from it; they drop into a chute and fall to the floor. The foot vaive is then released, exhausting the air from the cylinder and allowing the hose to be taken from the machine. This machine does not require skilled labor.

BY P. F. SMITH.

Chief Draftsman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.

Credit is also due to Thomas Marshall, Master Mechanic; Henry Holder, General Foreman; James Findlay, Machine Shop Foreman and James Lynch, Blacksmith Shop Foreman.

ROCKER BOX BORING BAR.

A simple bar for boring rocker boxes without removing them from the locomotive is shown in Fig. 26. It consists of a piece

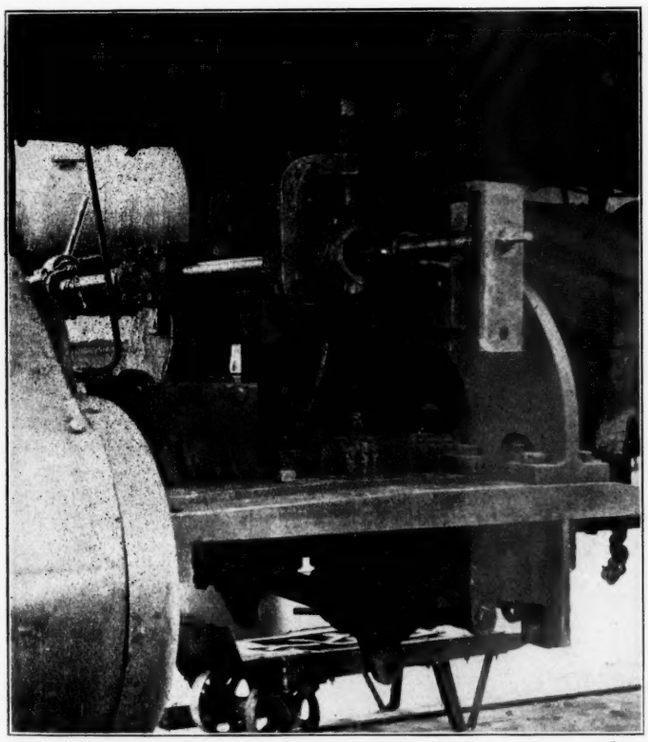


Fig. 26—Rocker Box Boring Bar.

of hollow tubing, with a taper shank fastened in one end to take the air motor. Brackets or bearings to support the bar are bolted to the guide yoke, and an L-shaped brace is clamped to one of the rocker boxes to support the feed screw at the end of the shaft opposite the motor. The feed may be operated either by hand or by fastening a wrench to the square end of the feed screw to hold it stationary.

ECCENTRIC MANDREL.

An eccentric mandrel for a lathe is shown in Fig. 27 and 28. It consists of a cast iron slotted base, which is bolted to the face plate of the lathe. The bar on which the eccentric fits is held in place on the base by a large nut. This bar may be adjusted for different throws of eccentric by the long screw which

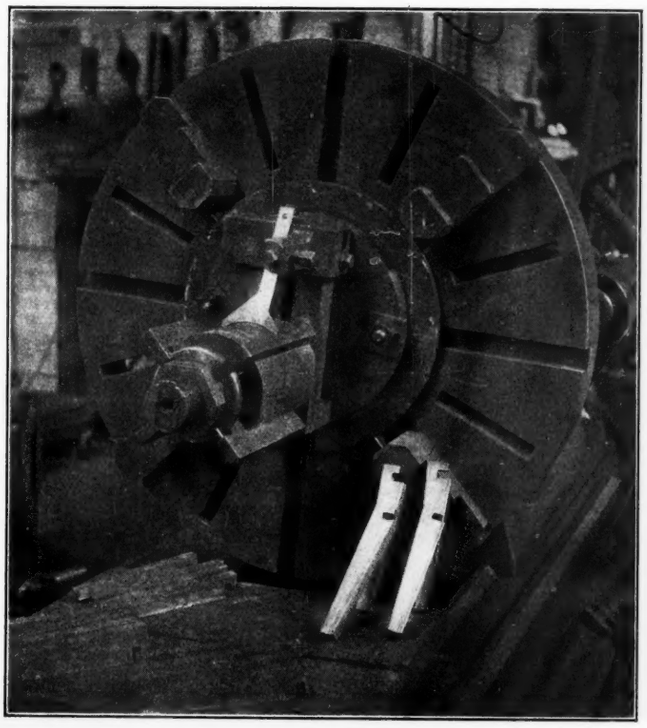


Fig. 27—Eccentric Mandrel.

passes through the base. As shown in the photograph, the bar has four slots in which tapered wedges fit. These are grooved near the outer ends to engage the collar of the large nut, the turning of which adjusts the wedges for the different sizes of axle fits. There is an adjustable dog on the base of the mandrel which engages the inside fillet on the center rib of the large half of the eccentric and holds it rigidly in place. Different sets of wedges to cover a wide range of axle fits are shown in the photograph. A gage for measuring the different eccentric throws is also shown resting on the mandrel.

BORING PISTON VALVE CHAMBERS.

A simple and efficient device for boring piston valve chambers is shown in Figs. 29 and 30. It consists of heads with tapered

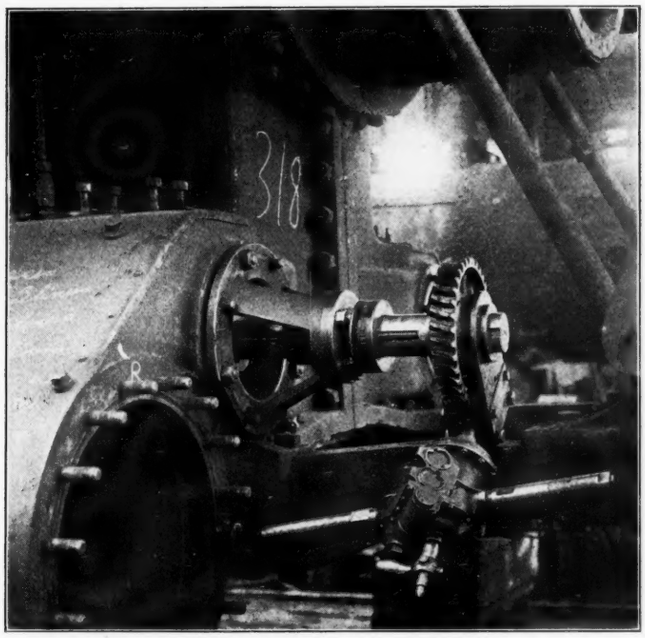


Fig. 29—Application of Device for Boring Piston Valve Chambers.

shoulders on the inner faces to fit the counterbores of the steam chest. This, together with the holes which fit over the steam chest cover studs, make it self entering. The heads are fitted

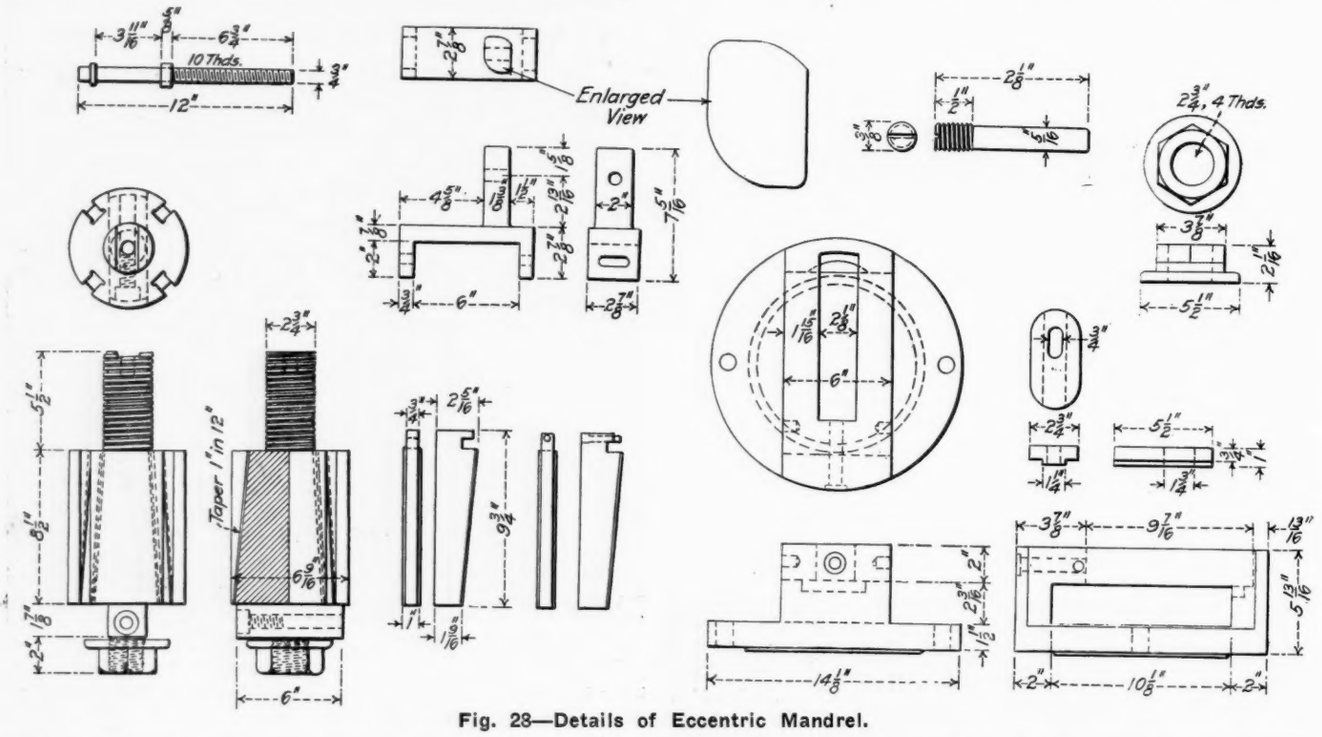


Fig. 28—Details of Eccentric Mandrel.

with bushings at their outer ends in which the boring bar fits; collars are so placed as to prevent the boring bar from moving endways. At the front end of the bar and clearly shown in the photograph is a worm gear which meshes with a worm. An air motor fits on the taper shank on this worm. The feed

MOLDING PACKING RINGS.

The machine for molding packing rings, shown in Fig. 31 consists of a 3-in. air cylinder which is controlled by a three-way cock. The cylinder is bolted to a frame constructed of angle iron; a yoke at the end of the piston rod is attached to the female former, the male die being fastened to the frame. The rings when removed from the mold are finished except that it is necessary to clip off and file down the lug formed by the gate

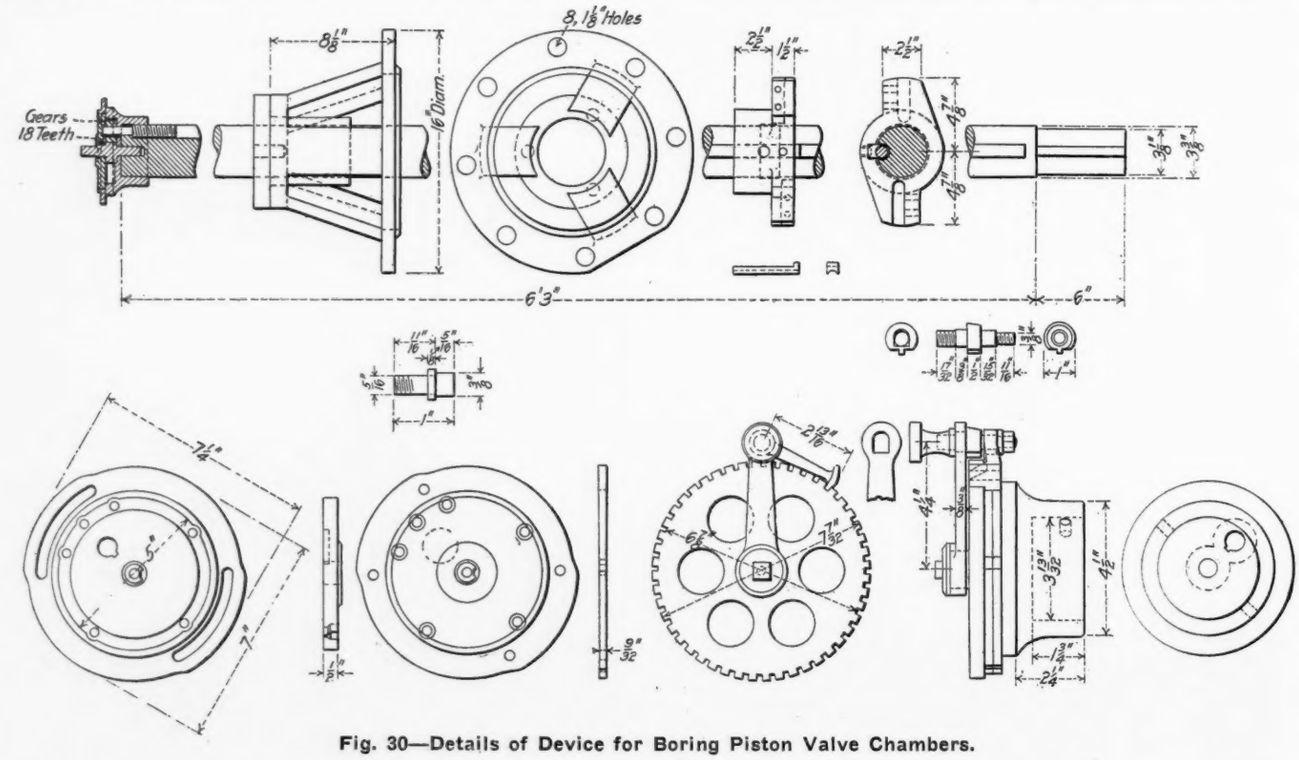


Fig. 30—Details of Device for Boring Piston Valve Chambers.

mechanism is placed at the other end of the boring bar and may be regulated to give either a fine or a coarse feed. Different heads are provided for the different size valve chambers.

for pouring. Finished packing rings are shown at the left. The outfit is equipped with a complete set of dies for the different sizes of piston, valve and air pump packing. The photograph

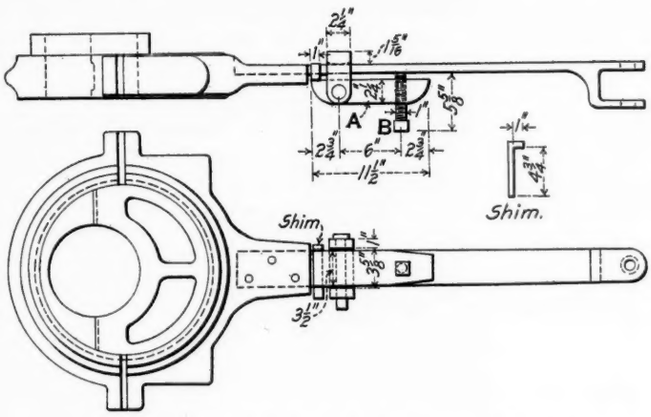


Fig. 32—Device for Bending Eccentric Blades.

shows the device tilted on one side to better illustrate its construction and operation.

BENDING ECCENTRIC BLADES.

It is often necessary to adjust eccentric blades after they have been bolted to the eccentric strap. The device for bending the blades shown in Fig. 32 is light and may be easily applied to either side of the blade. A number of shims to suit the different blades should be carried in stock. After the device has been adjusted by putting the 1-in. pin through the strap and the bar A, the blade may easily be bent to any position by turning the screw B.

CHUCK FOR HOLDING BOLT HEADS.

A chuck for holding the heads of bolts, which is much more convenient than the dogs or drivers that are ordinarily used, is shown in Fig. 33. The two parts of the clamp are each held at one end by a ⅝-in. stud bolt. In order to adjust the distance between them, they swing around these bolts and may be clamped in any desired position by tightening the square head stud bolts at the other end.

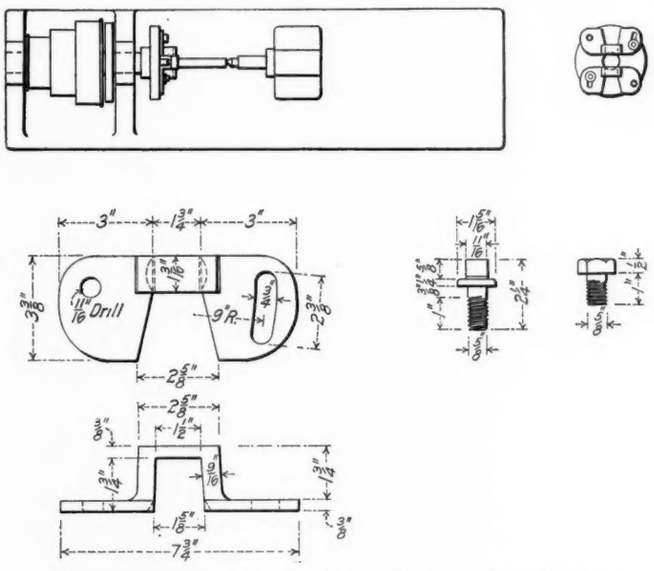


Fig. 33—Adjustable Chuck for Holding Bolt Heads.

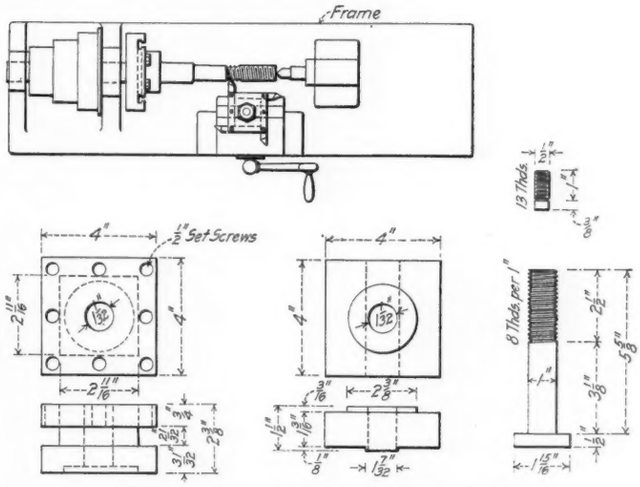


Fig. 34—Turret Tool Holder for Lathe.

LATHE TURRET TOOL HOLDER.

A simple lathe turret tool holder, to carry four tools, which may easily be constructed is shown in Fig. 34. Each tool is held securely in position by two ½-in. set screws, and the turret head is clamped to the carriage of the lathe by tightening the nut on the 1-in. bolt about which it revolves.

PISTON PACKING RING MANDREL.

The piston packing ring mandrel, Fig. 35, consists of a cast iron bell-shaped cone on a threaded spindle which is held

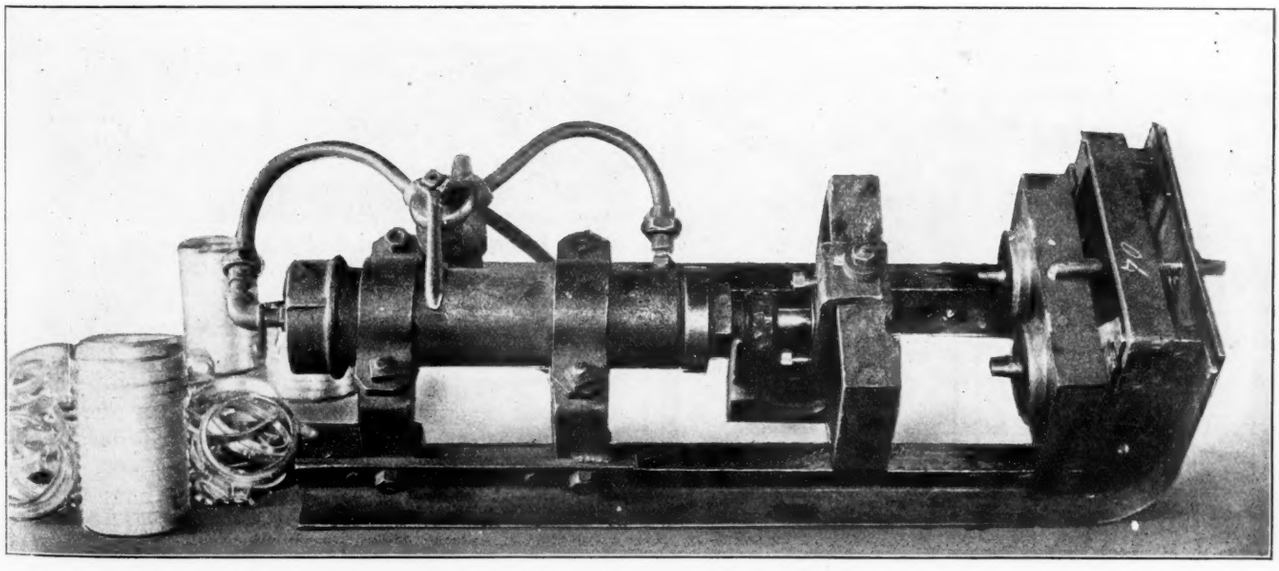


Fig. 31—Machine for Molding Packing Rings.

between the lathe centers. On the same spindle is pressed the flat casting, on which the slotted dogs with tapered ends to fit the taper on the cone are bolted. By turning the nut shown just in front of the bell-shaped cone, the dogs are forced outward from the center and engage the inside of the packing ring, as shown. A driver, which is bolted to the face plate, engages

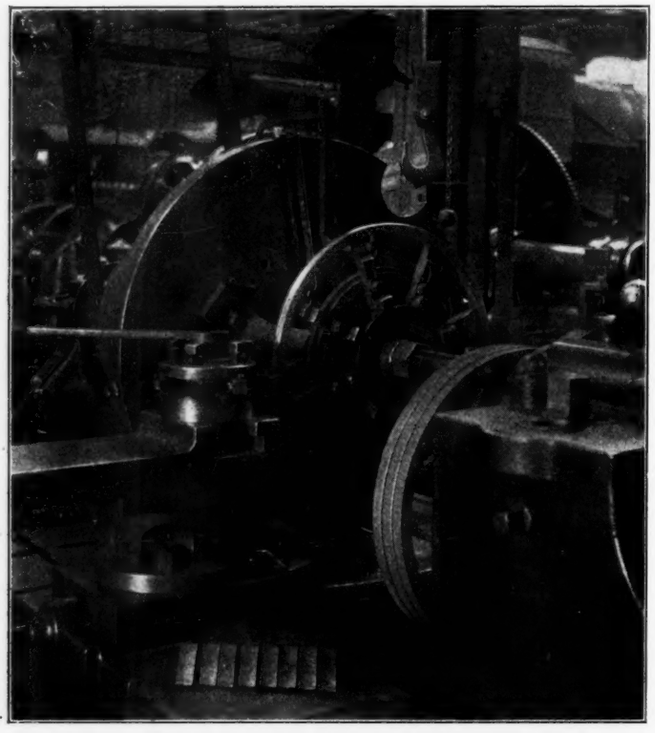


Fig. 35—Application of Piston Packing Ring Mandrel.

a dog on the spindle, thus driving the mandrel. Several unfinished rings are shown hanging on the tail stock center, and just back of the mandrel is an iron hook on which the finished rings may be hung. On the carriage in the foreground is shown an extra set of dogs for use on packing rings of larger sizes, which do not come within the limits of the dogs shown on the mandrel.

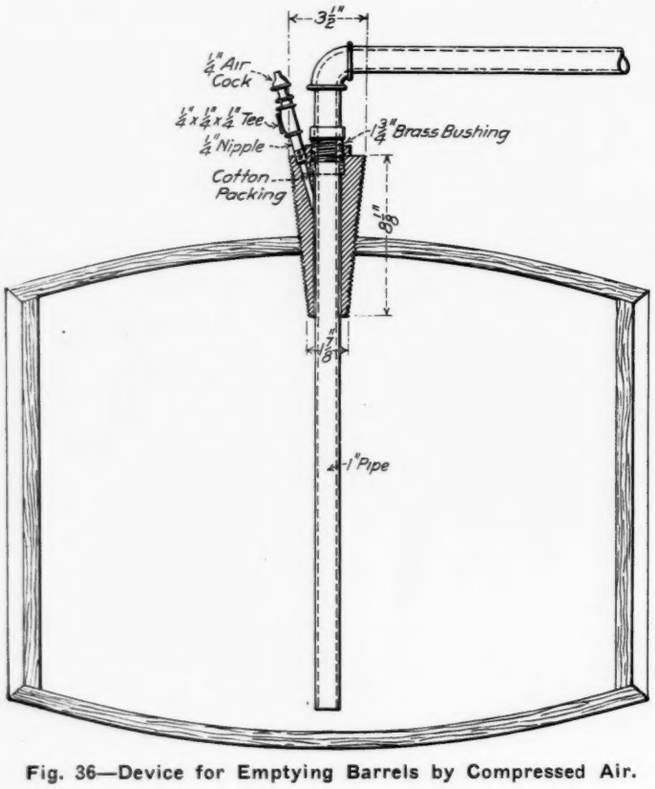


Fig. 36—Device for Emptying Barrels by Compressed Air.

DEVICE FOR EMPTYING BARRELS.

The device for emptying barrels by air pressure, which is shown in Fig. 36, is easily constructed and affords a rapid and cleanly method of transferring oil from barrels to storage tanks. The brass plug is screwed in the bung hole and the 1-in. pipe through which the oil is forced from the barrel fits snugly in the bushing which screws into the plug; the cotton packing makes a tight joint between the plug and the pipe. Compressed air enters through the ¼-in. air cock and nipple and passes

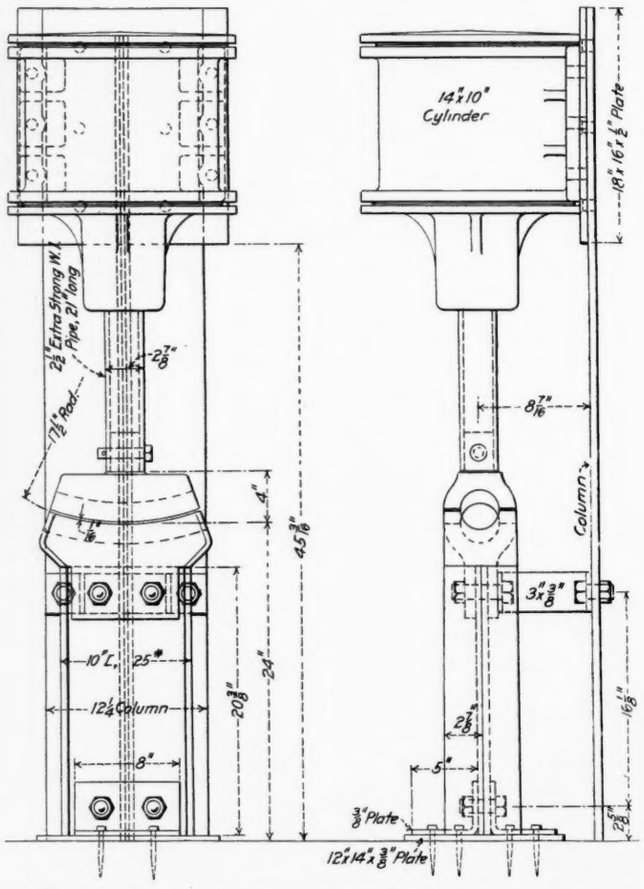


Fig. 37—Press for Forming Locomotive Arch Tubes.

down through a groove between the pipe and the brass plug, thus forcing the oil from the barrel.

ARCH TUBE FORMER.

A device for forming locomotive arch tubes to the proper shape is located in the boiler shop near an oil furnace in which they are heated. The power is supplied by a 14-in. x 10-in. driver brake cylinder, the air being controlled by a foot valve. The construction of the press and of the formers is clearly shown in Figs. 37 and 38.

DOUBLE BABBITT FURNACE.

A double furnace for melting two kinds of babbitt is shown in Fig. 39. The bases and the fire pots were taken from two old engine house stoves. Crude oil is used and each stove has a separate burner. The crucibles may be lifted in and out of the tops of the furnaces by means of the lugs. An extra crucible is shown in the foreground.

FORGING SMOKE ARCH BRACES.

The dies for forging both ends of a smoke arch brace under a steam hammer are shown in Fig. 40. The bottom foot of the

brace is first blocked out, as shown at the extreme right; it is then reheated and finished to the proper shape by the dies shown

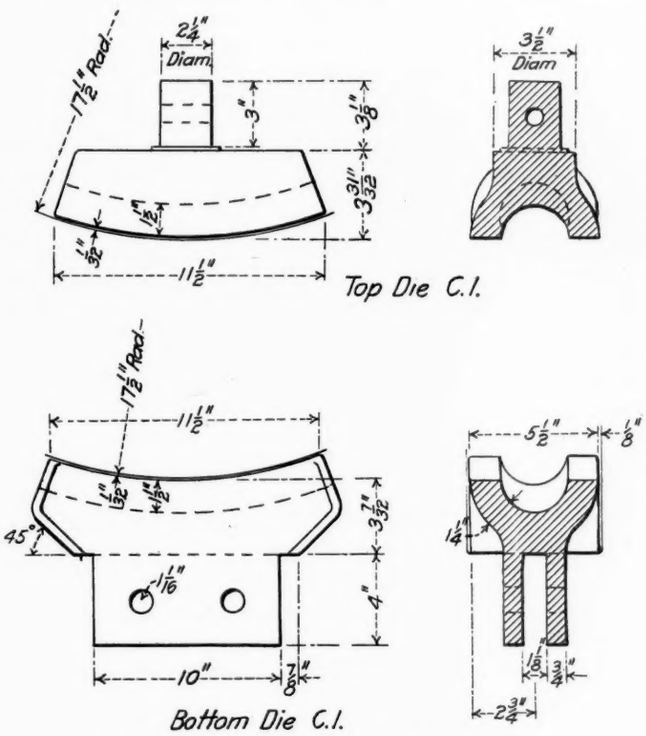


Fig. 38—Dies for Forming Arch Tubes.

at the left. The pad for the smoke arch at the other end of the brace is blocked out in the form of a ball, as shown near the center of the photograph, and is then reheated and formed to the

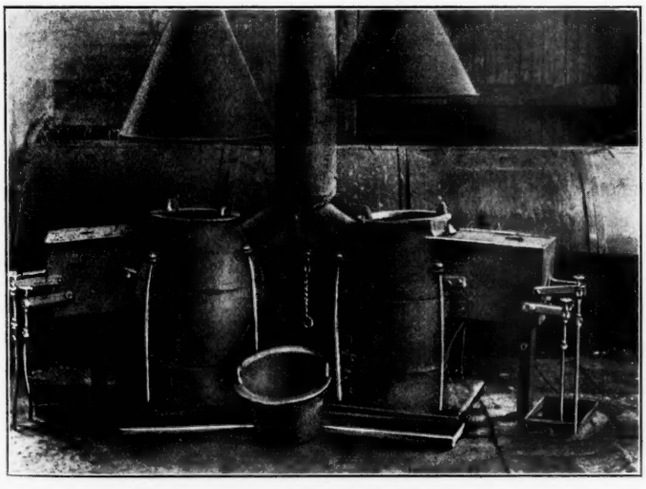


Fig. 39—Double Furnace for Melting Babbitt.

proper shape under the steam hammer in the large round die. The disk tool with the handle is then used to offset the pad and complete it.

FORGING COUPLER CARRIER IRONS.

The tools for forging the two members of an ordinary coupler carrier iron under a steam hammer are shown in Fig. 41. The stock for the bottom member is first bent, as shown by the piece in the foreground in the center. It is then placed on the female former at the left and the block is driven down into place. The former has steel inserts at its outer top edges, and by placing the two strips on the ends of the iron, as shown, it may be cut off to the proper length by one blow of the hammer. The top member is formed by the dies shown at the right. Both the top and the bottom members of the support are finished at one heat. A set of these ready for drilling and application are shown near the center between the two sets of dies.

Fig. 40—Formers for Forging Smoke Arch Braces Under a Steam Hammer.

FORGING ROD STRAPS.

Dies for forging rod straps are shown in Fig. 42. The strap is first blocked out in the ordinary manner and is then reheated

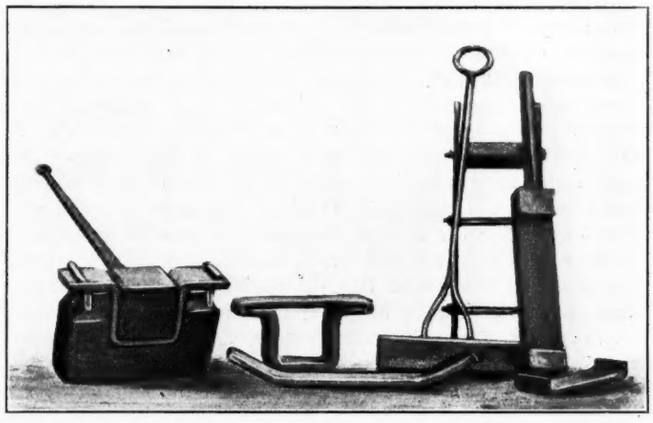


Fig. 41—Tools for Forging Coupler Carrier Irons Under a Steam Hammer.

and bent in the block shown to the left in the photograph. After both bends have been made the block for straightening and forming the inside of the strap is inserted; the clamp is

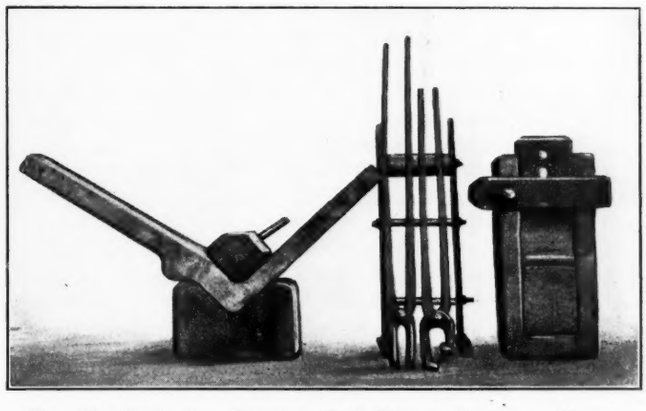


Fig. 42—Tools for Forging Rod Straps Under a Steam Hammer.

then put on and the block is driven down into place. The various tools for handling the strap in the different stages of its construction are shown near the middle of the photograph.

A bill has been introduced in the British Parliament to authorize the absorption of the Manchester & Milford Railway Company by the Great Western Railway Company.

THE MISTAKES OF THE EFFICIENCY MEN.

BY ONE WHO HAS WORKED WITH THEM.

II.

THEORY VS. PRACTICE.

The most common mistake of efficiency engineers, as pointed out in the previous article,* is their exaggerated statements and claims. Other mistakes, equally inexcusable, have been made and, unfortunately, are being repeated. Among these is the failure of many of their theories when brought to the test of practical application. Scientific management should, and does when correctly interpreted, include more than the visionary theories of a school of propagandists, many of whom seem to have no conception of the difficulties to be encountered in any serious effort to apply the principles of efficiency to railway operation. These principles do not alter, however theories concerning them may change. But as in the case of exaggerated and unwarranted statements, the chief harm comes through the obscuring of actual conditions. Not a few railway managers have lost confidence in the principles of scientific management because they have been incorrectly interpreted.

A theory of the efficiency men, widely quoted and commented on, has been used as the cornerstone of the structure reared as a defense against the alleged attacks of the railways on what have been assumed to be the inalienable rights of the shipper. They say that labor employed by railways averages about 70 per cent. efficiency and that 40 per cent. of the materials and supplies used are wasted; in other words, that waste is the rule and economy the exception. Further, that as it has been possible to increase the general efficiency of certain manufacturing plants to 100 per cent., this result is also attainable in railway operation. It is asserted that the avoidable losses to railways through the inefficiency of labor, including station men, train crews, clerks, shopmen, trackmen, etc., amount to $240,000,000 a year, and that the loss due to wasted fuel and supplies amounts to $78,000,000. It is necessary to consider here only one class of labor, as what may be said of it applies with equal force to all others. The largest single item is that of shopmen whose efficiency is alleged to be 70 per cent. This statement is intended to apply to the average of all railways in this country, for while on some roads the efficiency is greater, on others it is correspondingly less. An efficiency materially in excess of 70 per cent., however, has apparently not been credited to the larger and more truly representative systems, since they employ the greater part of the total.

The above mentioned theory assumes three things, none of which the efficiency men have proved: First, that the average efficiency is but 70 per cent.; second, that, if it is, the ideal of 100 per cent. can be realized, and third, that this will represent a net gain. These will be considered in the order named.

How is the efficiency of a workman arrived at? The theory is that 100 per cent. represents the amount of work an average man can perform in a given time. In order to determine accurately the times required for the innumerable operations of a locomotive repair shop, a study of the conditions surrounding each operation must be made and supported by actual demonstrations under normal conditions. When properly done such investigations are invaluable to shop managers and in the piecework shops particularly are a necessary part of the system for determining correct prices. In the most successful shops foremen or assistant foremen make these investigations and the results are not unsatisfactory as a whole, although the means used may not be strictly scientific. In the haste to "make a record" (for an efficiency engineer does not hesitate to promise almost immediate results) in introducing an efficiency system, time studies are made, often with the assistance of a stop watch, by inexperienced men of little tact—students and others equally incapable. Under such conditions it is not surprising that insufficient allowance is made for the failings of the average workman and the varying condition of the equipment. As a consequence 100 per cent. efficiency in actual practice is generally what an unusually capable workman can accomplish in a given time under ideal conditions. This is not an assumption or a theory on the part of the writer, who is well aware of the almost marvelous results that have been obtained in certain specific operations, such as bricklaying, carrying pig iron and others, and of the possibilities in this respect that lie before us in other directions. It is borne out by the evidence of scores of shop superintendents who have seen the experiment tried. And when the practical men who are close to the workmen and understand exactly how performance differs from promise, and practice from theory, give overwhelming evidence of these conditions their testimony cannot be ignored. After all the proof of the pudding is in the eating. But whether the efficiency of shop men is 70 per cent. or 80 per cent., more or less, the real weakness of the theory lies elsewhere.

Where has it been shown to be a practical possibility to increase the productiveness of shopmen from 70 to 100 per cent., that is, to obtain 43 per cent. greater output over their original efficiency, *and to maintain it?* Single instances may be cited, it is true, but they prove nothing. Evidence of this kind is interesting, but usually misleading. These instances in many cases are of men with more than the average intelligence and with uncommon ability to improve conditions by devising new methods and facilities. They do not by any means represent average men under normal conditions. Experienced managers always recognize the exceptional workman; they are the leaders of their class of whom there are only too few. The efficiency men seldom fail, however, to single them out as representing the possibilities of all men, and it is not an unusual occurrence for superintendents and foremen to be misled, by the evidence that John Brown and Tom Jones have increased their output from 70 to 100 per cent., into thinking that such results may be expected of all the men in their shop.

It follows from the assumption that because the efficiency of shopmen is but 70 per cent. (as alleged) there is an actual waste of 30 per cent., and conversely that an increase in their efficiency to 100 per cent. will represent an actual saving of 30 per cent. In other words that this saving can be effected *without cost.* This theory falls by its own weight and is not in accordance with the schemes for determining wages which the efficiency men have evolved. Yet it is used as evidence before the Interstate Commerce Commission. In actual practice, what does it cost to increase the efficiency of a workman from 70 to 100 per cent.? The hourly rate is guaranteed whatever the output. Assume that a man whose efficiency is 70 per cent. turns out seven pieces of a certain part in a day and that his wages are $3.50. Then the cost per piece is 50 cents. If he increases his efficiency to 100 per cent. his output will be 10 pieces and his earnings (according to the Emerson scheme of day rate and bonus) $3.50 plus 20 per cent. bonus, or $4.20, making the cost per piece 42 cents; a saving of 8 cents or 16 per cent. To this cost, however, should be added the expense of the greater organization required in maintaining such a system, which varies in certain shops but is conservatively 10 per cent. of the pay roll of the workmen. In many shops it is more than this. This amounts to 4.2 cents and makes the cost per piece 46.2 cents. The net saving is therefore, 3.8 cents, or less than 8 per cent. In this calculation nothing has been included to cover the cost of improved facilities which usually precede any marked increase in the efficiency, nor any part of the increased day rate of the workman which is usually granted as an additional incentive to increase his efficiency. Some things can be secured for nothing, but not labor. As the manufacturer aims to obtain the highest price for his product, so labor sells the fruit of its toil in the highest market. The shopman knows when his output has increased, and he demands the increased

* The first article considered the extravagant statements and claims made by efficiency engineers and appeared in the *Railway Age Gazette* of January 6, 1911.

wages which are justly his due. And no system can ultimately prevail, either in industrial plants or in railway shops, which will make men's minds or hands work more rapidly or more effectively, without paying the price—perhaps not always in the same ratio, but practically so. And in many instances to the chagrin of the efficiency men and with great financial loss to the employers, the results have been that after rates have been increased and a bonus given to insure to the employer a larger output, the men have finally succeeded in "beating the system." Then the output falls while rates remain the same. Thus it happens that often in the end not only is there no net gain in production, but costs have materially increased and the last state is worse than the first. No system has yet succeeded when the men affected by it are not in sympathy with its general principles. The first important step—gaining their confidence—cannot be done by rule.

That an average efficiency of 100 per cent. (as determined by the efficiency men) can be secured and maintained in a representative railway shop and that one standard should be accepted for all, no practical railway man will believe. Such a result requires ideal conditions with respect to buildings, equipment and other facilities and more important, and most improbable, with respect to all other men in the shop. Men cannot long be worked like machines. Such conditions may exist in certain industrial plants although it is seriously to be doubted. But the work done in a railway shop cannot be fairly compared with that in an industry where stock parts are made under conditions which do not change from day to day and by workmen who, each performing but a simple operation, are to all practical purposes parts of the machinery of the plant.

There is another theory abroad that has been widely advertised. It is that railway managers are unable through force of circumstances to bring about needed economies in railway operation, and that the application of the principles of so-called scientific management alone can insure relief from these conditions. This ignores the fact that long before the efficiency men appeared on the scene results had been obtained that have been adopted by them as standard. In order to support this theory evidence should be given to prove that what was before and is now impossible through the application of methods familiar to all successful railway managers has been accomplished by the efficiency system. The facts, however, disprove the theory. In a recent article on Saving by Scientific Management, a leading efficiency engineer states that the attainable standards for the average of all railways in this country in the maintenance of equipment are: Freight car repairs, per year, $35; passenger car repairs, per year, $500, locomotives, $0.06 per mile; and in support of the claim, certain railways are cited as having maintained their equipment during a specified time within these figures. Low maintenance costs have been secured on many of the representative roads, and to the extent to which motive power officials have the genius for organization and the capacity for handling men these results have become permanent. Low costs have also been secured on other roads, but for one or more of a variety of reasons have been but temporary in their character. If the efficiency men have been able to show on any railway greater *permanent* economies in operation than have been effected elsewhere without their assistance it has not come to our notice. It has already been pointed out in the *Railway Age Gazette* that the standards that were used on the only representative railway where the efficiency engineer has been given a trial were borrowed from roads where an efficiency system as such was unknown. If scientific management has gone further and made certain spectacular reductions in costs, it is safe to say that either conditions were woefully bad, the reductions have not been maintained, or the service has suffered. There is a difference between low costs and poor service and reasonable costs and good service. Inasmuch as the low costs cited from time to time by efficiency engineers have not been the result of their efforts, it is unfair to claim that only by means of scientific management can they be reproduced elsewhere. The fallacy lies in the assumption that a practical railway manager is unscientific.

Destructive criticism, that which destroys for the sake of destroying is common. It is easy to be an iconoclast. Constructive criticism, that which tears down a structure only to replace it by a better, is rare. Efficiency men gain nothing by refusing to recognize the means by which economies are usually effected in railway operation and by claiming for their systems results that can be secured by more direct and less theoretical methods.

One of the most successful of the pioneers in betterment work who has spent years in an effort to establish it in manufacturing plants and on railways has stated that he is successful only as he enters upon his work with an open mind, ready to labor side by side with the men who carry the load. There is a large and growing field for such a man. And railway managers will always welcome any efficiency engineer who has profited by the mistakes of his fraternity. The principles of scientific management are not new. Theories concerning them have to a large extent obscured their nature. But there are many, and their number is increasing, who recognize that successful railway operation is made up of a multiplicity of steps each carefully planned and carried out; that the problem is to control the parts in order that the whole may be controlled. This is scientific management.

THE USE AND MISUSE OF THE SCRAP PILE.

BY A SMITH SHOP FOREMAN.

A prominent railway officer has been quoted as saying "A railway's profit is in the scrap pile." In all probability he really meant that there was lots of money to be made or saved from scrap material, if it was properly handled. The truth of this is apparent after one has given the matter careful consideration. The scrap pile has often appeared to me to be the easiest place about a railway to waste or to save money. To save money, it is necessary for the master mechanic, or shop superintendent to have the earnest support of the general foreman and the foremen of the various departments in the effort to use all serviceable material that can be found in the scrap. All departments contribute to the scrap pile, but the principle contributors are the machine shop, boiler shop, blacksmith shop, coach and car shops, and the repair yards. If these departments were to contribute only such articles as are really scrap, the waste would not be so great; but various articles are thrown in the scrap pile that are in reality not scrap, but are often, either as raw material or articles ready for application, just as good as new.

Machine Shop.—Usually the machine shop foremen will take good care of scrap brass, babbit, tin and copper, knowing these to be high priced metals and alloys, but the same foremen will often neglect to pay sufficient attention to the waste of such articles as nuts, washers and bolts. When the price of these is taken into consideration—hexagon nuts 5½ cents per pound, square nuts 4½ cents per pound, and cut washers 3 cents per pound—and the fact that a small amount of this material is required to weigh a pound, it is easy to understand that a few of these pieces carelessly wasted each day will amount to quite an item at the end of a month, and to a considerable item at the end of the year. It is difficult to estimate accurately the loss occasioned by the careless handling of bolts, owing to the fact that some roads buy them and others make them.

Another serious and inexcusable loss that often occurs in the machine shop is caused by the misplacing of brass fittings, castings and forgings when an engine is being stripped for a general overhauling, thus causing the needless expense of providing new pieces in order to complete the repairs and return the engine to service. Again, there is sometimes a big loss occasioned by the careless handling of high price tool steel; for instance, after heavy tools for turning tires, etc., have become too short

for the tool post of heavy machines it is too often the case that they are carelessly laid aside and eventually lost when they should have been turned in to the foreman, or left with the tool smith to be drawn out into smaller tools for other machines. This loss is not likely to occur every day, but when we consider the price of a good grade of high speed steel, once a month is too often to have it occur when it could be so easily prevented.

Boiler Shop.—The principal loss in the boiler shop is occasioned by the careless and extravagant use of bolts, stay-bolts, nuts, washers and rivets, and the careless cutting and scrapping of sheet iron and steel—i. e., by cutting a whole sheet of steel to get a small piece when probably there are a number of pieces in the scrap pile that would serve the same purpose as well, if they were kept in order so that they could be found when wanted. This can easily be done by having a scrap bin built in sections close to the boiler shop, having several smaller sections for serviceable sheet iron or steel, and one large section for strictly scrap material. The number of sections reserved for serviceable material, would of course be regulated by the different sizes of sheet metal carried in stock; but it would not be necessary to have a separate bin for each size. The idea is so old and simple that the only problem connected with it is to school the foremen and the men to use it to the best advantage.

Car Department.—The loss caused by the improper handling of scrap material in the coach and car shop and on the repair tracks is pretty nearly the same and does not differ much from the machine shop, except in the scrapping of brake beams, car castings and forgings that are serviceable, or that could be made serviceable with just a little labor that would be inexpensive compared with the price of new forgings or equipment. With the hearty co-operation of the foremen with the general foreman and master mechanic, the waste can be reduced to such a degree as to become unworthy of comment. Probably the best way to eliminate the loss occasioned by the careless handling of bolts, nuts, washers and rivets, is to have bins built in sections, having a section properly marked or stencilled for each size nut, washer or rivet. A separate rack or bins should be built for bolts. The combined efforts of the shop foremen and the foreman of the scrap gang would soon convert these bins into a second hand store-house, and whenever the articles wanted could be found in these bins, not only would the cost be saved but the time consumed in hunting someone authorized to write an order on the store, and in going and coming from the store-house would be saved. There is nothing new in the method I suggest, but I am convinced that it is one that is not practiced enough, nor to the extent that it might be.

The cutting and rethreading of the longer broken bolts to be used in shorter lengths is practiced almost universally, but in a number of cases it is not practiced to the extent that a strict sense of economy would warrant or justify, and consequently the very results aimed at are not obtained. The car department uses all sizes of bolts from ⅜ in. to 1½ in., and if a strict system of keeping the repair tracks cleared of old bolts and keeping them in order to be used over to the best advantage is maintained, the storekeeper will be aided materially in reducing his monthly requisition for bolts.

Blacksmith Shop.—There is probably no department connected with the railway repair shop that can use scrap material so advantageously as the blacksmith shop. That is, if the scrap is kept in order so that it will not cost more to find it than it would to use new material. Yet there are cases where the scrap pile is so utterly disregarded by the smith foreman and his men, that they seldom resort to it except when the material wanted can not be found in the new material in stock. These conditions could and should be reversed, so that the smith will only use new material when serviceable material can not be conveniently found in the scrap pile. There is no great difficulty in inaugurating and maintaining a system of keeping scrap to be utilized in this way. The smith shop will require a scrap bin built in not less than five sections. Four of these should be used for serviceable lengths of material to be divided as follows: A bin for such shapes of iron as are not used extensively, one for round iron, one for flat iron, and one for open hearth steel; the fifth bin should be used for material that is strictly scrap. While this is an old and simple method of handling scrap, it is one that a great number of shops do not make use of, notwithstanding the fact that it means dollars and cents to the company. Old axles are used almost everywhere by the smith in making heavy forgings and for drawing short pieces of standard sizes of iron which cannot be found in stock for immediate use. But the same smith foreman will often neglect to use to advantage such scrap pieces as arch bars, sill plates, truss rods and draft rods, and many other pieces removed from old equipment, which are ordinarily sold as scrap. If the cost of loading it at the shops and of transportation is deducted from the price received for it, the net receipts from the sale will not amount to much. When we consider that tons of this material could have been used in place of new material and that the average price of the new material is about one dollar and seventy cents per hundred pounds, it is easy to undertsand that this sort of scrap can and should be handled more wisely.

Track Department.—The roadway department also disposes of a great deal of scrap. The principle extravagance indulged in by this department is the purchasing of new tools and equipment to take the place of old ones, and the improper disposition made of the old tools. Such tools as claw bars, spike mauls, track wrenches, picks, and track gages are often scrapped or misplaced by careless handling. The tools mentioned can also become so worn as to be entirely unserviceable and yet be thoroughly repaired at a cost far below the cost of new ones. With the exception of the track gages all of these tools can be neatly and quickly repaired in the smith shop. Another economy in the roadway department that is thoroughly practical is the repairing of frogs, switches and switch rigging. A frog can become so worn as to be dangerous and yet be repaired thoroughly at a small cost, while the purchasing of new frogs regardless of their size or description is very expensive. All of this work can be done safely, neatly, and quickly in the smith shop, with the exception of drilling holes and planing a rail that is tapered to a feather edge.

The problem of handling scrap material in a large modern railway shop calls for sober thought and the organization of a scrap gang headed by a man of intelligence; in addition to being intelligent, he should have fairly good mechanical ideas in order to reasonably determine what to save and what to scrap, as good material scrapped is money thrown away, and unserviceable scrap material kept on hand is money lying idle. The old adage that runs something like this: "Keep a thing seven years, and if in that time you find no need for it, keep it another seven years," might do very well for the farm, but not for the large railway shop where the scrap pile is so important from more than one point of view.

FIXING PENCIL LINES.

The *Revue de Mecanique* gives the following rules for fixing pencil lines on drawings that are not to be inked in, rules that will apply equally well on work done with hard or soft pencils. The first method is to rub the drawing with a piece of wax like that used in the manufacture of phonographic rolls. This produces a kind of varnish which protects the lines against rubbing and insures their preservation. Paper as well as tracing cloth can be protected in this manner.

Another method is to heat the paper slightly before using it, then spread a solution of warm alcohol and bleached colophone rapidly over the surface so as to thoroughly wet it, after which it is to be dried in warm air. The pencil works very easily on the surface of paper so prepared. In order to fix the lines, it is merely necessary to reheat the paper slightly for a few moments. The lines are thus covered with a thin coating of transparent varnish which preserves them in a condition of perfect clearness.

APPRENTICE INSTRUCTORS' CONFERENCE; NEW YORK CENTRAL LINES.

The fourth annual conference of the apprentice instructors of the New York Central Lines took place at the Grand Central station in New York, January 27, 1911. The conference had a peculiar significance, as a number of apprentices have been graduated during the past few months who were enrolled after the new apprentice system was inaugurated. All of the apprentice instructors from the ten shops on the system where apprentice schools are maintained were present. The meeting was conducted by C. W. Cross, supervisor of apprentices, assisted by Henry Gardner, assistant supervisor of apprentices. Others present were: J. F. Deems, general superintendent motive power of the New York Central Lines; F. E. McCormack, division superintendent of the New York Central & Hudson River; W. L. Davis, apprentice instructor of the Atchison, Topeka & Santa Fe, Topeka, Kan.; W. B. Russell, director of the Franklin Union, Boston, Mass., and formerly assistant supervisor of apprentices on the New York Central Lines; F. W. Brazier, superintendent of rolling stock of the New York Central & Hudson River; E. B. Katte, chief engineer electric traction; Fred H. Colvin, managing editor, *American Machinist*, and R. V. Wright, of the *Railway Age Gazette*. The names of the apprentice instructors follow:

Name.	Title.	Road.	Address.
A. L. Devine	Drawing Instructor	N.Y.C.&H.R.R.	West Albany, N. Y.
Chas. Pfister	Asst. Dr. Instructor	"	" " "
Elmer Knapp	Asst. Dr. Instructor	"	" " "
G. Kuch, Jr.	Shop Instructor	"	" " "
H. S. Rauch	Drawing Instructor	"	Oswego, N. Y.
W. F. Black	Shop Instructor	"	" "
F. Deyot, Jr.	Drawing Instructor	"	East Buffalo, N. Y.
F. Deyot, Sr.	Shop Instructor	"	" " "
G. Kuch, Sr.	Drawing Instructor	"	Depew, N. Y.
Joseph Latt	Shop Instructor	"	" "
A. A. Schafer	Drawing Instructor	L. S. & M. S. Ry.	Collinwood, Ohio.
H. J. Cooley	Shop Instructor	"	" "
C. A. Towsley	Drawing Instructor	"	Elkhart, Ind.
M. T. Nichols	Shop Instructor	"	" "
J. L. McTaggert	Drawing Instructor	Mich. Central	St. Thomas, Ont.
R. W. Middleton	Shop Instructor	"	" " "
C. P. Wilkinson	Drawing Iustructor	"	Jackson, Mich.
Robert Cook	Shop Instructor	"	" "
A. W. Martin	Drawing Instructor	Big Four R. R.	Beech Grove, Ind.
John Buehler	Shop Instructor	"	" " "
Howard Ihrig	Drawing Instructor	P. & L. E. R. R.	McKees Rocks, Pa.
Frank E. Cooper	Shop Instructor	"	" " "

The program opened with the reading of an address on The New Apprenticeship, prepared by G. M. Basford, assistant to the president, American Locomotive Company. It is as follows:

THE NEW APPRENTICESHIP.

Twenty years ago an apprentice boy entered a railway shop "down east." He was indentured and began his service with happy anticipation of the pleasure of learning the trade of machinist as many have done more recently. He worked six months "snagging" castings, gave up hope and quit. No one in the shop paid the slightest attention to him. No one thought of teaching him anything. He could not induce the foreman to put him on any other work and he became discouraged. He would have been given other work in due time and probably would have become a workman forming one member of the vast army of those who have learned trades according to this method. Shops today are full of such workmen and people say that apprenticeship is a failure. That kind of apprenticeship is, of course, a failure. It is worse. It is a crime. The company robbed the boy, not of money, for his pay envelope was not tampered with or his pocket picked, but he was promised an opportunity to learn a trade and was robbed of that in order that he should be used as cheap help. That, however, was not apprenticeship as we know it.

The following paragraph appears in the prospectus of the New York Electrical School and is an example of remarks frequently made concerning apprenticeship which are true of much that passed for apprenticeship in the past: "The apprenticeship system under which young men formerly learned a profession or trade is a thing of the past. At its best, it was a crude way of imparting knowledge, long drawn-out and tiresome alike to teacher and pupil, discouraging many of them before they had an opportunity of testing the system fairly."

This audience, however, represents a great movement, which is already national in its scope, dedicated to the proposition that the new apprenticeship is the only way to prepare young men for mechanical pursuits. Those who are in position to understand the results already attained are sure that we are right and that in the long run general acknowledgement of success will be accorded. If we carry out the work on its present lines we can not fail and it will be surprising if we cannot improve on them.

Do you realize that the new apprenticeship contains two elements which the old never had? The first of these is the individual attention of shop instructors who are competent mechanics and who have nothing else to do. The second is mental development in school coincident with the shop development. Do you realize the advantage which you as instructors enjoy over the teachers in public schools and even over college professors? Your pupils have not only selected their callings, but they are actually following them and they are holding their own and making their way among men earning their own living. This brings about an ideal relation between pupil and teacher, which does not exist in any other field of educational work. Other educators work with pupils who must make places for themselves after and because of the education. You educate workers in their work. There is a vast difference in these conditions which is not understood by school men and others who argue that the trades should be taught in schools.

The advantage which you enjoy over other teachers brings also a corresponding responsibility, for you must introduce methods specially adapted to the character of your problem. You are closer to your pupils than are any other teachers. This is the chief reason why you cannot use ordinary methods and ordinary text books. This is one reason why you need to be better teachers than seem to suffice for other conditions and other methods. Because you know very definitely what the boys need and because they use their knowledge as soon as it is given them you stand in the best possible position as educators. This fact should in itself be an inspiration in the shop and in the classroom. For example, consider the teacher of algebra in a public school. He teaches a subject without having the remotest idea of just how the pupil will be called upon to use it. The teacher's work is indefinite, unreal, separated from life, and is like a shot in the air. On the other hand, you educate a boy in laying out a boiler sheet knowing that he will use the knowledge in order to hold his own in the shop. Is there not a vast difference between the two cases? It makes little difference how algebra is taught. It is, however, of the utmost importance that the boy should be taught the best way, the New York Central way, to lay out that boiler sheet, and he should know why it is the best way. He should also know that the slightest defect in this work involves trouble, delay, unnecessary expense and increased difficulty in the steps in the work which are to follow.

In the school room, because you know very definitely what the boys need, you are in position to educate them to think, which is an object difficult to attain in the indefinite work of the public school. It is certainly a privilege to teach under such favorable conditions, but you need to be the best teachers in the world because you are responsible for preparing the American workman for his work. Remember that it will be easy to measure the results of your work and that they are sure to be measured.

In a movement such as that in which you are engaged it is of the first importance to know in the most definite way what you are trying to accomplish. If you have never attempted to define the object of apprenticeship and cover the ground that you desire to cover in a few words you probably do not realize the difficulty of doing so. The Commission on Industrial and Technical Education, reporting to the State of Massachusetts in 1906, stated the object of industrial education in the following words: "The Commission was told at almost every hearing that in many industries the processes of manufacture and construction are made

more difficult and more expensive by a lack of skilled workmen. This lack is not chiefly a want of manual dexterity, though such a want is common, but a want of what may be called industrial intelligence. By this is meant mental power to see beyond the task which occupies the hands for the moment to the operations which have preceded and to those which will follow it—power to take in the whole process, knowledge of materials, ideas of cost, ideas of organization, business sense and a conscience which recognizes obligations."

It is difficult to conceive of a better statement than this of the object of the group of men here assembled. This comprehends the training of the hand and the training of the mind of the workmen of the future. The closing words concerning "a conscience which recognizes obligations" reveal a field of effort to which I specially desire to call your attention.

You are dealing with boys in the most impressionable age of their lives. They are at the age when the influences of home, of the church and of the public schools are likely to be weak or altogether wanting. The boys are perhaps away from home, but if at home they are drifting rapidly toward manhood and are forming the habits of their lives as to thought as well as in the occupation of their hands. They are about to establish their ideals and select companions whose influence is likely to last throughout their lives. In short, they are embyro citizens beginning to realize the independence which comes from earning their own living. At this stage you are thrown in contact with them more closely than is any other human influence. You may impress them with your own personality, your own ideas, outlook and hopes, you may bring before them standards which they will adopt. You may not do any of these things. Your influence depends very largely on your own personality, your knowledge of boys and boyhood and your ability to acquire close proximity to their lives. Perhaps you may not realize the importance of this contact, but it seems reasonable to expect that if you can get upon such close footing with them that they will trust you with their troubles, ask your advice and take you into their confidence, you will be able to mold their future to a very large extent. Do you appreciate your responsibilities in this direction?

Nothing is to be feared from the influence of any man skilled with his hands and developed in his mind for independent thought and action, but much is to be feared from a large class of workmen skilled or unskilled who allow others to think for them and who are morally weak in that they will not act with the courage of their own convictions. It seems to me that the greatest problem before the instructor of apprentices today lies in that part of the work which has to do with conscience and citizenship, and that in this direction lies the greatest opportunity for apprenticeship development. In this lies your greatest responsibility. If you do not realize it you fail to accomplish the greatest of all the objects lying before you.

A great deal may be accomplished through apprentice organizations, debating clubs, athletic teams and other influences which tend to develop individual initiative in connection with the team work idea. Boys need to manage something to develop self government in order to realize that the world has a right to expect them to take their places in the human organization of life in general and in order that they may become self-reliant units in that organization.

Summing up I would like to lay before you three facts: You are working under ideal conditions as to the relationship between instructor and pupil. This relationship renders it possible for you to exert most powerful influences over the character and the future of your students. The most vital object of this whole movement is to produce men, American workmen, skilled, resourceful, honorable men, men prepared and inclined to fulfill their obligations.

CONSERVATION OF WORKMEN.

F. H. Colvin, managing editor of the *American Machinist,* spoke as follows on the above subject: "You are doing good work in teaching the boys the fundamentals of mechanics and shop mathematics and in training them for the production of good work at a reasonably rapid rate. Increasing the output of any machine by using improved methods rather than depending entirely on increased manual effort is true conservation of the capital invested. In a like manner the conservation of the workman is equally important in the broad economical view of his relation to manufacturing and to the community.

"Nearly all the states are paying considerable attention to the problem of compensation for injured workmen, and there is no doubt that we will follow in the footsteps of the older countries in this respect. This question is unfortunately usually discussed in the attitude of antagonism by both sides, instead of from a standpoint of mutual interest. Under the guidance of your instructors, or even a special instructor who can cover other points of a similar nature at your various schools, who has a real personal interest in the boys and their welfare, and who commands their confidence, the proper relation between employer and employed can be made clear and helpful to both.

"One of the difficulties with all large corporations is that of instilling workmen with the idea of individual responsibility, both to the company and to their fellow employees. An instructor of this kind could do much toward pointing out this individual responsibility in the way of properly caring for machines and tools, so that they would not be a source of danger to themselves or others. He could make clear the penalties of taking chances with a belt which needed lacing or cementing, of unnecessarily going into dangerous places, and many other points which are responsible for more injuries than any of us realize.

"It is not solely a question of compensation, but one of economic loss to the individual and to the community. Even if the injured workman receives full wages, there is a distinct loss in the production of that shop, and this indirectly is shared by him as an individual number of the community, and to every man in the shop, whether he or they realize it or not. Everything which is destroyed represents cost to some one. A nut or washer shied at a dog and not recovered is a distinct loss, just as is the destruction of a man's usefulness through unnecessary accidents. Guards must be used to be of value. The time will come when failure to use them may mean dismissal, as the responsibility cannot all be placed on one side. There is no question that the economic and political future of this country depends largely upon the intelligence of its workmen, and anything that we can do that will aid in the formation of a broad foundation cannot fail to be a lasting benefit to ourselves and to our various communities.

"Any reduction in the number of accidents is a distinct gain from any point of view, and there is no question but that education can help in this direction as well as any other. It is very often less a matter of carelessness than of a recognition of individual responsibility. Whether this work should be done in your classroom or at special meetings is a matter of detail. It is even possible that much of the work can be done by the shop instructors, who have practical examples constantly before them."

J. F. Deems, general superintendent motive power, under whose direction the new apprentice system was inaugurated said: "I have watched with a great deal of interest the work that you men have been doing; not only watched it from the reports sent in and investigations that I have made in going over the road, but by making inquiries from others outside of railway work who have investigated your work. I congratulate you on what you have done and what you are doing. It was not an easy task when you took it up. You had very little to guide you in the work, and you have accomplished much more than I hoped for in the length of time that you have been at it."

F. W. Brazier, superintendent rolling stock, drew particular attention to the necessity of the instructors cultivating executive ability, and stated that in order to make a success of his work as the head of a department he had to have every one with him, even to the office boy. He also spoke strongly against the use

of cigarettes and said that he would not promote a man in his department who used them.

E. B. Katte, in an inspiring talk, emphasized the necessity of "learning men." Education is a good thing, but a man to exert a strong influence on those about him, either when working with them or directing them, must really know and understand the men and their characteristics.

C. W. Cross, supervisor of apprentices, spoke in part as follows: "It is gratifying to know that there are now at least twelve railways in the United States where a systematic course of apprentice instruction is being pursued with marked success. Skilled instructors are leading the young mechanics through graduated courses to a thorough knowledge of their calling and the results are so far most encouraging. The important element of natural selection is markedly active in many of the shops. Under proper instructions it is speedily recognized whether the young man has made the proper choice of a calling or not. The unfitted are weeded out and directed to other fields. The moral and intellectual tone of the student apprentice is elevated. Life becomes sweeter and higher and nobler when the difficulties of a calling are illumined by intelligent and kindly instruction. The burden of labor lies lightly on the shoulders of the studious youth who can call the gathered wisdom of a proficient instructor to his aid. To this is added another important factor—that the amount of work or output of the apprentice shows a marked increase where there is an instructor. Hence the apprentices under the new system are being better paid with the result that instead of being a burden on their parents or guardians during their apprenticeship, the young mechanics are self supporting from the beginning, and when they graduate they have the proud consciousness of knowing that they are fitted to take part in the world's work without fear or favor.

"On March 1, 1906, the apprenticeship department was created and a few weeks later the work was well started at nine of the shops. We have completed the cycle of the work and the graduates now turned out have had the full four years course of training. The courses of study have been revised and improved and specialized to fit the several trades in a manner that has met with the approval of all interested persons. The graduates are used to good advantage in the service and as a proof of the efficiency of the training system, when graduates are re-employed as mechanics at the completion of the apprenticeship they are given a generous rating, and in many cases the maximum rate in the trade in which they are re-employed."

W. B. Russell expressed appreciation at the fact that in two or three instances boys who were apprentices when he gave up the work a year and a half ago had successfully completed their courses and had developed so rapidly as to have been made apprentice instructors or assistants.

In presenting his annual statistical report Henry Gardner, assistant supervisor of apprentices, stated that on July 1, 1910, 617 apprentices were enrolled, which is an increase of 62 over the previous year. Fewer apprentices were discharged during the year, showing that more attention had been paid to weeding out the unsuitable and unruly boys during the six months probationary period. In addition to very complete statistics, a large number of specially good jobs which had been done by apprentices while working in the shop drafting room or in the shop were mentioned. The report might indicate that too many high grade men were being turned out in proportion to the number of mechanics who would be content to remain in the shops for an indefinite period. Mr. Gardner stated, however, that it must be understood that many of the instances mentioned in his report were unusual and that no mention had been made of the fact that capable mechanics were being turned out who would remain in the shop and be a credit to it, because it was understood that this condition did prevail and the unusual incidents were referred to to show the extent to which an ambitious boy might develop under the new apprenticeship system. In the discussion the question came up as to whether it was advisable to attempt to raise the standard of the apprentices too high. Mr. Rauch, of Oswego, had gone on record at a conference two or three years ago with the statement that he would very much prefer to have apprentices from the seventh or eighth grade of the public schools to those who had partially or entirely completed a high school course. Observations at Oswego had compelled him to change his mind, and he is now willing to take all of the high school boys he can get. Of 17 apprentices graduated at Oswego, of whom about 25 per cent. were high school boys, only two had left the service.

Mr. Davis, of the Santa Fe, stated that the high school boys developed far more rapidly and did better work, but that they did not remain in the service. For instance, at Topeka about one boy in every 25 comes from the high school. Of 25 apprentices graduated at that shop last year, 23 were still in service at Topeka, and the other two were with the company at other points on the system. At Fort Madison, where a large percentage of the boys are from the high school, seven had been graduated in the same time and all had left the service.

Mr. Martin, of Beech Grove, reported that 25 per cent. of the apprentices at that shop had attended high school, but that in four years only one of the graduates had left the service. Mr. Russell, however, called attention to the fact that the high school training at Indianapolis was such that better results along these lines might be expected than at other places. Mr. Cross was emphatic in the statement that the apprentices on the New York Central Lines were not all stars by any means.

PRIZES FOR EXCELLENCE.

In discussing the question as to whether it was advisable to give prizes to a few apprentices for good work or to try to advance a large number of apprentices moderately, H. S. Rauch, of Oswego, said: "Assume that the company agrees to reward each apprentice who passes through his course with a standing of 90 per cent., and otherwise completes his apprenticeship in a manner satisfactory to his superior officers. This reward to be in the form of a check for $100, which to the average apprentice would look like a fortune. I certainly believe that it would be an incentive for all to work harder to gain the goal. But would this prize stimulate a desire for knowledge for the sake of knowledge itself; would it be instrumental in the creation of a good healthy love of work? Would we not be placing a temptation before the boys to get this 'average of 90 per cent.' regardless of how they got it? It is true that the instructor is in a position to discover dishonesty of this character, but what would be done when the discovery was made; would we bar the apprentice from further competition for the prize or would we discharge him? In either event the effect would be demoralizing. Then how about the slow, plodding, hard working young man who does not grasp things as quickly as some of his fellows but who retains and puts to good use all that he does learn due to the fact that he had to work so hard to learn it. This type of young man would become discouraged when he realized that his averages were not up to the standard and felt that however hard he might work there was little chance of his winning.

"Let us look at the other side—at the boy to whom nature has apparently been most kind; everything comes to him without much effort, he concentrates his mind for a few moments and has mastered the subject. This boy is a natural prize winner, but he wins prizes for the sake of their possession and not for any benefit which he might derive from the study which gives him the right to possess them. He becomes haughty, imbued with a feeling that he is far superior to the slow kindly classmate at his side, and again our purpose is defeated, for instead of producing harmony and co-operation we have produced only discord and discontent.

"Let us imbue the future mechanic with the idea of attaching himself permanently to the organization, not by holding out to him a prize that might be his downfall, but a prize that will inspire confidence in all alike, be they bright or dull, by giving

him a living wage that will spur him on to a good healthy love of work."

Discussion.—The general opinion seemed to be that this would be a most unwise provision to make. Some boys are good in the shop and poor in the school room, and vice versa. It would be extremely difficult to decide how to award the prizes fairly, and it is doubtful if any good object would be attained. Prize winners do not always make the best workmen or employees. Mr. Davis stated that on the Santa Fe each graduate is given $75 at the completion of his course if his work is satisfactory. If he remains with the company for six months he is given $75 more.

RESULTS OF MODERN APPRENTICESHIP.

F. Deyot, Sr., of East Buffalo, spoke of the advantage that the modern apprentice has for acquiring a complete knowledge of his trade in a comparatively short period. The great advance in shop practice which has taken place within recent years has made the life of the mechanic of the old school one of continuous study to keep up with the times. The discussion of this subject brought out the fact that care should be taken not to carry the apprentices too much, but to urge them to take responsibility and to develop self confidence, so that when a boy leaves the apprentice department he will be fully prepared to stand on his own merits and to take such responsibilities as may be placed on him.

COURSE FOR ELECTRICAL APPRENTICES.

C. A. Towsley, of Elkhart, Ind., outlined a complete course for electrical apprentices. The increased use of electricity in connection with shop equipment and operation, and car lighting has made it imperative to provide such a course, as there are now a number of electrical apprentices on the system. It was also suggested that a part of this course, at least the fundamental principles, could be added to some of the other courses to good advantage. In the machine shop, for instance, electric drives are now being used to a considerable extent, and it is believed that the cost of maintenance of the motors and controllers could be reduced considerably by educating the mechanics in the care and operation of this equipment, at least to a slight extent. Mr. Russell said that the results obtained in Boston have been such as to demonstrate that the only way of successfully instructing the practical mechanic in these matters was by the use of electrical apparatus in the laboratory, with a minimum amount of lecture or class room work. As a proper laboratory equipment would be too expensive to install at any one shop, he suggested the advisability of equipping an instruction car with such apparatus, which might be used for all the shops on the system. Mr. Katte mentioned some talks which had been arranged for the instruction of the electrical employees at the railway Y. M. C. A. in New York. As far as could be seen, these talks did not accomplish any great practical results. The theories of electricity are most difficult to understand, but electric apparatus is comparatively simple in construction.

LABORATORY WORK.

E. Kennedy, of Depew, and W. F. Black, of Oswego, presented papers describing the methods of instruction in laboratory work. To show how interested the boys were in this work Mr. Kennedy said: "We had a class which came to the shop one Sunday and trammed an engine on the erecting floor to satisfy themselves that they could do the actual work after learning the job from the wooden model. It is good policy to take the same class of boys two or three months later and let them go over the same work on the models to see if they have retained what was taught them and to renew their interest.

"As to the value of a new classroom course for machinists based on shop practice, opinions may differ. Give a boy a mechanical magazine with no cuts or illustrations, and another magazine containing several illustrations and see which one will interest him most. Invariably it will be the one with the pictures, probably from the fact that in combining the cut and the accompanying explanation, he can more readily see what the author means. For example, explain to an apprentice how to find the speed of a pulley or any job of that sort, and nine times out of ten, he will forget it the next day; but give him a picture of the pulleys and their sizes together with the question, formulae and answer all on the same sheet, and it becomes interesting. You have captured the boy's attention. This is one of the ways to make a new machinists' classroom course based on shop practice most beneficial; put in plenty of pictures. The regular home and classroom problems for general use are all that can be desired in their line, but to fill the wants of the machinist apprentices a new course pertaining to shop work entirely is really necessary."

Mr. Black said: "In the laboratory at Oswego we have a set of models used for the purpose of instructing the apprentices in the art of laying out from blue prints. These models are of wood and are copied after spring rigging and driver brake parts; the method of instruction is to give the apprentice the model covered with paper, together with a blue print from the standard files, showing the part he is to lay out; then he proceeds along the same lines that he would in the shop. After he has completed this task the work is checked up by the instructor and if not found O. K. must be done again. We have found this instruction invaluable to apprentices who are to be placed where laying out is to be done.

"We have found that any instruction which we are able to give in the laboratory during the last half hour of the session has been productive of flattering results in the shop. This is due to several reasons; the boy's mind is not distracted by the noise and the hustle of the shop and he realizes that he is being paid by the hour while receiving instruction and is more apt to concentrate his mind upon the work in hand than he would if he was working piece work, where time means money."

WALSCHAERT VALVE GEAR.

Benjamin Frey, of St. Thomas, said: "It is important to take into consideration the relation between the time the classroom instruction is given and the time the apprentice takes up this branch of his trade in the shop. I do not think that we should wait until the boy is in the valve setting gang before we begin to teach him the principles of valve motion in the school room. By a little co-operation between drawing and shop instructors, the boy should gain a fair general knowledge of the mechanism and know what is meant by the terms valve travel, lap, lead, cut-off, etc., before he takes up valve setting in the shop. He should also know how to read the markings on the valve stem and keep track of them in an intelligent manner. He will then be able to grasp this end of his trade more readily in the shop, generally increasing the respect of some of the journeymen who are not always desirous of telling all they know about this particular work.

"In order to make a success of teaching valve motion in the classroom it is necessary to have a model which is adjustable; one with such adjustments as will produce practically the same conditions in valve setting as are found in actual practice. This will not only require less of the instructor's time in explanation, but will tend to stimulate the interest and enthusiasm of the apprentice. When two boys are prepared to take up valve setting in the classroom, the model is thrown out of adjustment and they proceed to set the valves. All operations and adjustments should be made by the boys. The duty of the instructor should only be to give advice here and there as the boys require it. After the valves have been set the model is again thrown out of adjustment, but in a manner to produce different conditions than found in the previous setting. Under these new conditions the boys again proceed to set the valves. In performing the work they should, of course, exchange their duties, so that each may gain all the points possible from the work. In this way the model is continually thrown out of adjustment and reset by the boys until one of them is able to set the valves under practically every condition without assistance from the instructor. We then

appoint this boy to teach the other until he has mastered the subject well enough to take the place of the first boy. We then consider the first boy O. K. as far as the classroom instruction goes, and then allow the second boy to teach a third. Later the third boy will teach a fourth and so on in the order that the boys take up the work in the shop. The instructing boy should, of course, ask the instructor at any time about any point he desires to have explained. By this method more of the instructor's time can be devoted to the other class work, and the boys are at the same time kept interested by competition to become the head or instructing boy.

"We allow the entire class session to those boys who are using the model for valve setting as it is almost impossible to make any headway in teaching this subject during a shorter period, and the boys who are following in another class will not break into the partially completed work of the first set of boys."

Mr. Cook, Sr., of Depew, has made a practice of giving the apprentices an actual demonstration of valve setting in the shop with good results. Mr. Martin, of Beech Grove, has found it advisable to have the boys work on the Walschaert model in the school room a week or two before they go on this work in the shop.

THE BACKWARD BOY.

F. E. Cooper, of McKees Rocks, said: "Few boys are good in both the shop and the school. When a boy is found to be slow in school his case should be given careful consideration. He may have been turned against the school by older journeymen who have not had an opportunity to get much education and therefore are a little prejudiced. He may have been told that the school work will not hold his job for him. When a boy gets that idea in his head he should be given a sensible talk by both the shop and drawing instructors. If that fails try to interest him in the school work by giving him work in the shop that will correspond somewhat to the work in the school. This may be done by giving him a blue print and telling him to perform the necessary operations on a machine or having him lay off a piece of work without giving him any instructions or allowing him to receive any; then if he gets stuck and cannot go ahead he will feel ashamed of himself and you can give him a good sensible talk as to why the school is a great help in learning the trade. After this the boy will usually begin to take a greater interest in the school work as well as that in the shop.

"It requires a great deal of patience to bring around a boy who is slow in the shop. If a boy is slow on a job and cannot get it out in the specified time, the instructor should prove to him that it can be done in the time set and show him where he loses time. If the boy is slow but willing, we should not turn him down unless his case is hopeless; sometimes by letting the slow boy follow a good one on the machines he begins to see that he is slow and picks up. The instructor should study the boy's nature; some boys you can coax along, while with others you have to use a little force."

Discussion.—It pays to take pains to develop the backward or slow boy, and when he has been developed he usually makes a first-class mechanic and remains in the service. In not a few instances boys have been found who cannot make a good showing in the school room, but who are splendid mechanics. The only way in which a dull boy can be developed is by patient and painstaking effort on the part of the instructor, but it is well worth the effort.

LOYAL AND SATISFIED APPRENTICES.

A. W. Martin, of Beech Grove, said: "A long step toward the accomplishment of this is to maintain constant interest in the work by making every feature of the course attractive and by the shifting of tasks as frequently as possible without upsetting the shop schedule or lowering the shop efficiency. Let the boy fill the place of a mechanic in his absence and try to make him feel that the company is endeavoring to make him a good citizen and mechanic, as well as to increase the output in as economical a manner as possible.

"I have experienced but very little trouble in keeping the boys satisfied and interested in their work. However, I must admit that there are cases where they become indifferent. Then I try to make a special effort to find out what the boy is most interested in. When I think he is far enough advanced in his regular course to branch off on special work, I allow him to do so for a short period. Doing this stimulates a better feeling in the boy toward his studies and often brings him to a point where he can see the importance of carefully observing every little detail in his instruction papers; when he returns to his regular course he goes at it with renewed interest. Changes of this kind are undoubtedly beneficial to the boys in many ways."

Discussion.—Instructors should remember that boys watch closely and try to follow those men with whom they come in contact, whose personalities appeal to them. It is important, therefore, that the instructors watch themselves carefully that they may set a proper example for the boys, and not only that but that they make an effort to get the foremen and the men with whom the boys come in contact to do the same. Examples were cited of boys who had been discouraged. A little effort on the part of the instructor could locate just what influence was working on the boy, and steps could be taken to overcome it. If it was found that one of the workmen in the shop was carelessly talking to him in such a way as to discourage him, the difficulty could easily be corrected by getting the man off to one side and talking the matter over with him.

The moral effect of having the foremen and mechanical officers visit the school room is very great, and this practice should be encouraged. Mr. Davis spoke of officers of the Santa Fe, including the vice-president, Mr. Kendrick, stopping off at the schools whenever they found opportunity and giving the boys a talk. The boys should be encouraged in athletic sports, and wherever possible the foreman and the shop superintendent should try to attend the games. Much may be accomplished in encouraging the boys by having the instructor give the shop superintendent a memorandum of those who have made specially good records or who need encouragement. The shop superintendent can then at his first opportunity look the boy up and personally commend him, or if he needs encouragement, I give it to him. The boys forget that the shop superintendent or general foreman is the "old man" and feel more kindly toward him when they find him waving his hat in the air and rooting at a baseball or football game. The foreman should be urged to attend the apprentice club meetings or any of the social affairs of the apprentices and to mix up with them.

MONTHLY REPORT FOR PARENTS.

Mr. Kuch, Sr., told of the good that had been accomplished by sending monthly report cards to the parents of the apprentices showing the progress which they were making. The next month the dull boys and the sluggards made an earnest endeavor to raise their marks for their standing had been criticised by their parents. A number of acknowledgments were received from the parents, showing their appreciation of the efforts being made in behalf of their boys by the company.

Discussion.—The concensus of opinion was that a simple report, which could be sent home to the parents each month, indicating the standing of the apprentice in his school and shop work, would be productive of good results. It was suggested that the first report be sent through the mails with a letter asking for the coöperation of the parent and explaining the report fully.

RECORDS.

G. Kuch, Jr., of West Albany, made some suggestions concerning a simple form of record card which would show the attendance and punctuality of each apprentice and also how his time had been put in each day. In discussing this report several of the instructors were emphatic in saying that lateness should not be tolerated.

CAR BUILDER APPRENTICES.

Mr. Shafer, of Collinwood, in speaking of the car builder apprentice said: "The question of keeping the car builder apprentice thoroughly interested in his trade for a period of four years is a problem not easy to solve. We are continually being brought face to face with the fact that the apprentice, and also the prospective apprentice, is inclined to believe that car building is not and will not be a desirable vocation to follow. Journeymen of this trade do much toward hindering the progress of the apprentice and cause him to lose interest in his work by telling him that car building is nothing more nor less than menial labor which can be performed by the most unskilled workman. Another point is the wages paid to the car builder. Because some other trades command higher wages, they are believed to be greatly superior. We must bring the car builder apprentice to a point of view where he can see that his trade is of some importance and that we are giving courses of study which pertain strictly to car building." Mr. Shafer outlined a course of study for such apprentices.

Discussion.—At present there are about 62 car department apprentices on the New York Central Lines. F. Deyot, Sr., of East Buffalo, stated that they had considerable difficulty in securing apprentices, as freight car work only was handled at the East Buffalo shops. The work of the school at that point was described in the *Railway Age Gazette* of August 5, page 231. A complete car builder's course of study is in preparation.

APPRENTICE EDUCATION FROM THE STANDPOINT OF ONE OF THEM.

Richard Keefe, one of the apprentices at Oswego, has the faculty of expressing himself in a most original and readable manner, as may be seen from the following paper which was read at the conference.

"One morning on going to the shop from the classroom, a few minutes after nine, the foreman put me on a job with a first-class mechanic whose first salute to me was: 'The railway is losing money on you fellows.' I took this to be a morning grouch and let it past. After a while he lifted his head from a paper he was making faces over and said: 'Say, can you make this out? Dumbed if I can and I've been at it all morning.' He held out a blue-print but I didn't jump to take it; then with a little less acid in his tone he said: 'I generally make these out at home but last night the kid was sick, and I couldn't think.' The sick kiddy was too much for me so I took the blue print and had no difficulty in reading it. This ability to read blue prints is an important side of apprentice education, but just as important is the ability to meet an emergency, or to have confidence in an undertaking and the willingness to be led, all of which are felt rather than seen and are the direct result of our training.

"Every mechanic expects the apprentice to 'hop' to his music; every apprentice knows the mechanic will 'kick' to his tune, for the mechanic has no time for the 'greeny.' The only man who understands apprentice language is the 'angel,' which is slang for shop instructor, but it is no miss to call him such, for without him the greeny would never grow, but would be at a standstill half his time. Sometimes we wish the angel was twins, even triplets would no more than meet the demand. Of course the mechanic is not greatly to blame, as under the present system, 'time is money.' Piecework is not a good school for the apprentice to become an expert workman in, he catches the spirit of rush and hustle that is round about him, and soon is satisfied if his work just does, without any desire to improve it; he may make more pay and often does if work is plenty, but he loses sight of the main object of work which is perfection.

"The rate paid a first year apprentice is out of proportion to his needs; even a first yearer must eat like a man and dress as a man in order to work like a man; he looks like a man and feels like a man until he puts his hand in his pocket. The apprentice who clothes himself, buys tools, carries some protection, pays apprentice club dues, church and shop collections, is obliged to pay his nearest relatives for board, washing and mending in 'promissory notes' (no time of payment specified), must be blind on the girl side of the road and put the curb on a growing sociability. All this hurts; it might be called, 'apprentice cramp'; it squeezes the region of the short rib and produces imperfect vision. A dime looks the size of a car wheel and it makes as many revolutions in his pocket as one going a mile a minute before it disappears into spend-land. I might go further and say it leads to defective hearing, for the jingle of small coin is so sweet to the ear that many a fellow adds keys, nails and tool checks to swell the sound so that in time he becomes tone deaf to the ring of real money. Apprentice cramp is a disease that carries off many of the first yearers and deters many other desirable fellows from becoming apprentices. Another trouble is the discovery that physically he is not adapted to the trade he has started, yet rather than start another at first year rate he drops out. This is a loss to the railway as well as to the boy and it's up to them to remedy it. The high school boy of today is more inclined to mechanics than ever before if the rate paid was more proportional to his wants.

"The classroom is the smoothing iron that rubs out all the wrinkles of discontent, for the apprentice looks forward to these hours with pleasure. 'Up to the college,' has almost the ring of 'come on to the ball game,' and the class instructor is regarded as a 'dad' by all the boys. Even the fellow who went in with a sneer goes out with a thank you. Next to the school is the club; here the apprentice spreads his wings for his first flight in oratory, here he gets used to hearing his own voice and gets over the scare of the sound of it, here he also sharpens up his wits for defense or his tongue for attack and here he talks railway, reads railway and grows to be a railroader.

"The great disadvantage of apprentices in the railway shops is the uncertainty of keeping the job. We are at the mercy of every foreman and we have no court of appeals. In many cases the class instructor stands our friend, but he is outside of the shop and cannot be expected to be judge and jury. The question we ask ourselves oftenest is, what is the railway going to do with us? If the road does not want us, we have practically wasted our time. Take for example the apprentice who has served a couple of years at the machinist trade; his knowledge won't count for much outside the railway shop if he is fired and yet it is of great value in the shop if it sees fit to use him. Take the carpenter apprentice who can do anything from building a cab to laying track, lagging a boiler or wiring a shop. Of what use will this be to him if the road does not want him and he has to seek work with a house builder? The railway is big enough to be a life work for the most ambitious if promotion was arranged so that the apprentice would know where he stood as he went along.

"In summing up I must not forget those little keys that open up the world to the apprentice and are the one thing he does not outgrow (they appeal even to the grey-beard), namely, the passes. These serve to educate him as well as school or club, and most of all they make him feel that he is an investment and an investment in the biggest thing in the world, the railway."

RAILWAY AGE GAZETTE DINNER.

The apprentice instructors were the guests of the *Railway Age Gazette* at a dinner at the Engineers' Club on Friday evening, January 27. Following are the more important points which were brought out in the impromptu after-dinner talks:

Mr. Davis, of the Santa Fe, mentioned the encouragement which was given to the apprentice movement on the Santa Fe by the higher officials. He said: "I notice that when our president, Mr. Ripley, speaks before any of the railway associations he usually manages to slip in a word or two about the apprentice department. When Mr. Kendrick, the vice-president, goes over the line he does not visit all the places, but invariably, and especially if he has company on his car, he visits the apprentice schools." The apprentice instructors are always ready to give the boys advice, when they come to them, and do so in a painstaking and truthful manner, thus gaining the confidence of the boy. An apprentice if found smoking cigarettes is discharged.

Mr. Rauch, of Oswego, emphasized the necessity of setting a good example. Every young man between the ages of 16 and

22 has an ideal which he is trying to follow. The instructor should give the boy the same kind of advice that he would give to his own sons. Never tell an apprentice you will do something that you are not absolutely sure you can do; in that way you will gain his confidence and respect.

Mr. Schafer, of Collinwood, who was only graduated from the apprentice ranks a comparatively short time ago, said that many of the boys wished to know just what the possibilities for advancement were in railway service. His answer was: "It is up to you; if you can make good and deliver the goods there is a better job waiting for you."

Mr. Gardner, the assistant supervisor of apprentices, quoted Martin Gower, formerly supervisor of apprentices on the Canadian Pacific, as saying that in order to be successful, a man must have a good character, common sense and an education. Of the three, education is the least important, and the instructors should strive to develop and impove the other two.

Mr. Cooley, the shop instructor at Collinwood, spoke of the value of the practical shop training that is carried on at the same time as the school work. He told of a college man who came into the shop and did not understand how to perform a comparatively simple operation. After it had been explained to him he said: "I wish I had worked in a shop and learned the trade before I went to college, for then I would have known what I was studying about."

Mr. Vauclain, of the Baldwin Locomotive Works, made an address, and among other things said: "My own instruction dates back, like yours, to my mother and then to my father, and then to the other fellows, and it will be surprising for you to know that I have working for me today, as an engineer, one of the first outside instructors that I ever had. Before I reached the dignity of pantaloons, when I was a mere child, this man used to carry me around on his shoulders and tell me all about the different parts of a locomotive; he would take me with him on the locomotive, and I would ride through the tunnel with him and would get ballyhoo from my mother when I came home and a smile from my father; this man still instructs me. There is hardly a week goes by that he does not come in and say that there is something that I will have to do if I want to make our locomotives more satisfactory to our customers. He is 87 years old and is listened to with the most considerate attention, and his advice is generally good. Now, why is this? It is because the boy—and I am still a boy so far as that man is concerned—has learned to have confidence in his instructor. If all of you gentlemen here who are instructors succeed in obtaining the confidence of your pupils, your apprentices, you will be sure to be successful with them. It is only when a pupil fails to have confidence in his teacher that the teacher has a difficult time in instructing.

"The boys in your shops are picking their instructors. They are not necessarily selecting a man appointed by the company to instruct them, but if he is the right kind of a man his instruction will survive, because the boys will all cling to it and he will be successful. A man cannot remain as an instructor for any number of years unless he has the boys behind him taking him as their standard. The whole system becomes standardized."

C. W. Cross, supervisor of apprentices, emphasized the importance of the instructor studying the boys carefully and striving to exert a strong moral influence over them.

ALUMINUM IN CAR CONSTRUCTION.

The *Zeitschrift des Vereines Deutscher Ingenieures* calls attention, in a recent issue, to twelve cars that have been put in service on the Zurich tramways, in which all of the metallic portions of the body are made of aluminum. In addition to its lightness, the metal has a further advantage, in that when it is cleaned with a sand blast, simple painting suffices to protect it. Varnishing, which is needed on steel plates, is thus dispensed with, and the loss of time and the large expense in applying it are saved.

STANDARDIZATION OF CHILLED IRON CAR WHEELS WITH REFERENCE TO SERVICE CONDITIONS.*

The object of this paper is to establish the simple laws which determine the proper relation of the chilled iron wheel to service conditions, and necessarily the conclusions are based on the long experience and complete records of the Griffin Wheel Company, covering the performance of ten million wheels.

The economy in the chilled wheel, as compared with other parts of the car for increasing capacities, is shown in the following table:

Capacity of car	20,000	40,000	60,000	80,000	100,000
Per cent. of increase.....	...	100	200	300	400
Average weight of car, lbs.....	18,000	24,000	30,000	36,000	42,000
Per cent. of increase.....	...	33	66	100	133
Weight of heavy cars, lbs.....	18,000	40,000	48,000	56,000	64,000
Per cent. of increase.....	...	122	166	211	255
Weight of wheel, lbs.....	525	550	625	675	725
Per cent. of increase.....	...	5	19	29	38
Weight of axle, lbs.....	350	450	550	730	870
Per cent. of increase.....	...	29	57	109	149
Weight of body of car, lbs.....	12,400	17,800	23,000	27,900	32,900
Per cent. of increase.....	...	43	86	125	165

The economy of wheels in service is even greater than shown, because it is only since 1909 that the M. C. B. standard wheels were of the weight shown for 60,000-lb., 80,000-lb. and 100,000-lb. capacity cars. The 600-lb., 650-lb. and 700-lb. wheels for these classes of cars represent the majority of wheels now in service. The comparison of relative increases in weight for the increasing capacities is shown on the chart (Fig. 1). The wheel from the lightest to the heaviest capacity cars shows an increase in weight of only 38 per cent., while the axle has increased in weight 149 per cent., and the weight of the car, exclusive of wheels and axles, has increased 165 per cent. The rails on which the wheels operate have increased 100 per cent. Whether or not the weight of the chilled iron wheel has kept pace with the increasing service demands is determined by the record of wheel performance in each class of service and it will be shown that with 95 per cent. of the total equipment the performance of the chilled iron wheel is eminently satisfactory.

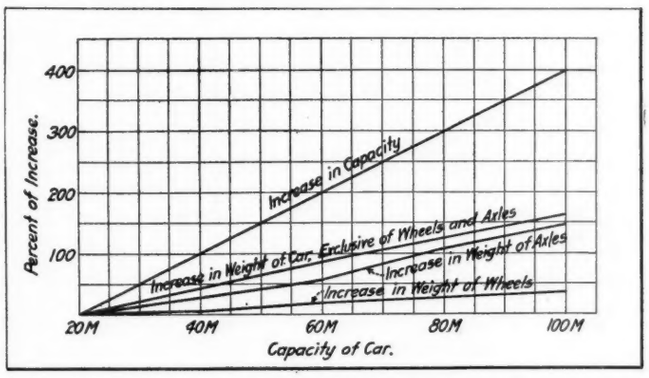


Fig. 1—Increase in Weight of Various Parts of Freight Cars.

The performance of wheels under modern heavy freight cars has been remarkable when we consider the rapidity with which these cars came into service, giving no time for experimental work as far as the wheels were concerned. In fact, the cars have not yet been in service long enough to obtain the records of the best wheels. The wheel removals each year contain some of the original wheels placed under the first 100,000-lb. capacity cars that were built. The best evidence we have of the performance of the chilled iron wheel under 80,000-lb. and 100,000-lb. capacity cars is from our replacement records of wheels which failed to make their guarantee, comprising all of the wheels manufactured during the years 1905, 1906 and 1907, the time limit for the guarantee having just about expired. This

*Abstract of a paper read at the January, 1911, meeting of the Western Railway Club by a representative of the Griffin Wheel Company.

list contains 1,020,463 wheels as follows, manufactured by Griffin Wheel Company:

	650 lb.		700 lb.	
	Total.	Replaced.	Total.	Replaced.
1905	173,286	1,250	59,949	709
1906	278,815	3,183	166,220	2,547
1907	198,356	1,295	143,837	834
Total	650,457	5,728	370,006	4,090
Per cent.	.....	.88	.....	1.10

These percentages of replacement represent all wheels which failed to make the guarantee for worn tread, shell out, cracked plate, seams, broken flange, broken in pieces and defective castings. Wheels weighing less than 600 lbs. reached their maximum in 1892 and have been on the decline ever since.

The years of maximum production were in 1906 and 1907, with a falling off in the following years, which would indicate that railway equipment was placed in a better average condition during the years 1906 and 1907, and a large percentage of the wheels manufactured in those years are still in service.

During the year 1909 the M. C. B. Association recommended as standard three weights of chilled iron wheels, viz., the 625-lb. for cars of 60,000-lb. capacity; the 675-lb. for cars of 80,000-lb. capacity, and the 725-lb. for cars of 100,000-lb. capacity. The performance of these wheels is practically perfect when operating under conditions which can reasonably be interpreted as conforming to those of the three classes of cars. It would naturally be supposed that the equipment of all railways would be divided into three classes so that all items of service relating to the wheel should be proportionate to the 625-lb., 675-lb. and 725-lb. wheel. While this is true of 90 per cent. to 95 per cent. of the equipment, there has been a tendency of late in certain sections to increase the percentage of brake pressure to the light weight of the car, and in the case of refrigerator cars and heavy furniture cars of light capacity, the weight of the car allows a higher braking power in total than corresponds with its capacity. It is of extreme importance that the capacity of the wheel should correspond with the intensity of the braking power of the car.

It is doubtful if one wheel in a million would break in service if applied to such cars as we may reasonably infer are specified in the M. C. B. recommendations for each capacity. It is therefore important that the recommendations be closely studied and followed—they are as follows:

MASTER CAR BUILDERS' RECOMMENDED WEIGHTS OF CHILLED IRON CAR WHEELS.

Weight of wheel.....	625 lbs.	675 lbs.	725 lbs.
Axle capacity	22,000 lbs.	31,000 lbs.	38,000 lbs.
Gross load	88,000 lbs.	124,000 lbs.	152,000 lbs.
Deduct car capacity.....	60,000 lbs.	88,000 lbs.	110,000 lbs.
Weight of car.....	28,000 lbs.	36,000 lbs.	42,000 lbs.
Brake pressure at 70 per cent.	19,600 lbs.	25,200 lbs.	29,400 lbs.

NOTE.—80,000-lb. and 100,000-lb. capacity cars calculated at 10 per cent. excess load.

Summary.

	Gross Load.	Brake Pressure.
625-lb. wheel designed for.....	88,000 lbs.	19,600 lbs.
675-lb. wheel designed for.....	124,000 lbs.	25,200 lbs.
725-lb. wheel designed for.....	152,000 lbs.	29,400 lbs.

The brake pressure under the majority of equipment is 70 per cent. of the light load of the car, and using this as standard we may determine the brake pressure corresponding to each wheel. Heat is developed through brake friction; therefore, the brake pressure when continuously applied represents the rate at which heat is being developed, other things being equal, and therefore, brake pressures should be proportional to that part of the wheel which resists the temperature stresses—the plate.

RELATION OF BRAKE PRESSURE TO STRESSES IN THE WHEEL.

The question arises just how to determine the relation of the wheel to the brake pressure. As stated above, we assume that the conditions as laid down by the M. C. B. Association are entirely satisfactory, and by considering the braking strength of the plate to vary as the square of its thickness, and its strength in tension when resisting temperature stresses to vary directly as its thickness, Table No. 1 was prepared for and published by the Association of Manufacturers of Chilled Car Wheels.

TABLE No. 1.

Thickness of Plates Required in Cast Iron Wheels to which Brakes Are Applied.

Maximum Gross Load on 8 Wheels.	Thickness of Plates Required in Each Wheel to Safely Carry the Load.	Total Braking Power of Car.	Thickness of Plate to Be Added to Take Care of Temperature Stresses.	Required Thickness of Tread.
Pounds.	Inches.	Pounds.	Inches.	Inches.
40,000	.36	12,500	.16	....
50,000	.41	15,000	.19	....
60,000	.45	17,500	.22	1.50
70,000	.48	20,000	.25	....
80,000	.52	22,500	.28	1.62
90,000	.55	25,000	.31	....
100,000	.58	27,500	.34	1.75
110,000	.60	30,000	.37	....
120,000	.63	32,500	.41	1.87
130,000	.65	35,000	.44	....
140,000	.68	37,500	.47	2.00
150,000	.71	40,000	.50	....
160,000	.73	42,500	.53	2.12
170,000	.75	45,000	.55	....
180,000	.77	47,500	.59	2.25
190,000	.79	50,000	.62	....
200,000	.81	52,500	.66	2.37
210,000	.84	55,000	.69	....
220,000	.86	57,500	.72	2.50
230,000	.87	60,000	.75	....
240,000	.89	62,500	.78	....
250,000	.91	65,000	.81	2.50

TABLE No. 2.

Weights of Various Diameters of Wheels with Different Thicknesses of Plates.

Thickness of Plates in Inches.	Weight of Wheels. 36 in. Diam.	33 in. Diam.	30 in. Diam.	28 in. Diam.	26 in. Diam.	24 in. Diam.
.62	640	550	480	440	390	350
.68	665	575	500	455	405	360
.75	690	600	525	470	420	375
.81	715	625	550	485	435	390
.87	740	650	575	500	450	405
.93	770	675	600	520	465	420
1.00	800	700	620	540	480	435
1.06	830	725	640	560	495	450
1.12	860	750	660	580	510	460
1.18	890	775	680	600	525	470
1.25	920	800	700	620	540	...
1.31	950	825	720	640	...	...
1.37	980	850	740	660	...	...
1.43	1010	875	760	...	...	...
1.50	1040	900	...	...	...	...

Table No. 1 divides the required thickness of the plate required in a wheel for ordinary railway service in two parts:

1.—That required to carry the load.

2.—That required to resist temperature stresses as represented by brake pressure.

The sum of these quantities gives the required thickness of the plate in the wheel.

Table No. 2 has also been prepared for the Association of Manufacturers of Chilled Car Wheels to show the approximate weight of a wheel for all usual diameters when the thickness of plate is specified. With these two tables at hand it requires but a moment to decide whether any wheel harmonizes with the service conditions. The method of using the table is as follows:

Example.—What wheel should be used under a refrigerator car having a gross load of 90,000 lbs. and braking pressure of 37,500 lbs.? Referring to Table No. 1 we have the following:

Thickness of plate corresponding to gross load of 90,000 lbs. .55 in.
Thickness to be added on account of 37,500-lb. brake pressure. .47 in.

Total thickness of plate.....1.02 in.
Referring to Table No. 2, weight of wheel is.....700 lbs.

Table No. 1 is for use only when considering cars in miscellaneous service, that is, where cars of all classes are coupled together in one train; the application of this rule is simply to produce a distribution of retarding force to each wheel in proportion to its size. When the trains are made up of the same kind of cars and operated on heavy grades, another principle applies. In this case the wheels are all alike and the braking power uniform on all cars, hence the rate at which heat is produced is determined solely by average gross load and the rate of grade. In this case it is entirely immaterial how brake pressures are calculated, for it is self-evident that sufficient braking power for each car must be used to offset the gravity effect of the average gross load per car, and no more or no less. To take care of this situation Table No. 3 has been prepared.

This table shows how the weight of the wheel should vary with operating conditions and is intended as a guide for choos-

ing the proper standard wheel to suit any operating condition. From the experience gained in observing the performance of trains made up of fully loaded cars of one kind and operated on 4 per cent. grades, such as often occurs in mining districts, the maximum safe operating conditions for wheels have been established and are shown in Table No. 3.

TABLE NO. 3.

Effect of Gross Load and Grade on Wheel Design.

	1%	2%	3%	4%
Gross Load 75 tons.				
Thickness plate, in inches, to carry load.....	.71	.71	.71	.71
Additional thickness for grade.....	.15	.30	.45	.60
Total thickness	.86	1.01	1.16	1.31
Weight of wheel, lbs.....	646	706	766	825
Gross Load 60 tons.				
Thickness plate, in inches, to carry load.....	.63	.63	.63	.63
Additional thickness for grade.....	.12	.24	.36	.48
Total thickness	.75	.87	.99	1.11
Weight of wheel, lbs.....	600	650	700	750
Gross Load 50 tons.				
Thickness plate, in inches, to carry load.....	.58	.58	.58	.58
Additional thickness for grade.....	.10	.20	.30	.40
Total thickness	.68	.78	.88	.98
Weight of wheel, lbs.....	575	612	654	692
Gross Load 40 tons.				
Thickness plate, in inches, to carry load.....	.52	.52	.52	.52
Additional thickness for grade.....	.08	.16	.24	.32
Total thickness	.60	.68	.76	.84
Weight of wheel, lbs.	550	575	604	637

Use of Tables.—These tables furnish a ready means of examining any operating condition of freight cars and freight engine tenders to determine whether the wheels are properly standardized. The tables represent the maximum safe combination of load and braking power that are safe for chilled iron wheels. The safe operating stress for the wheel is governed by the properties of metal of which the wheel is composed. Operating conditions of load, grade and brakage are fixed by the railway. The obvious responsibility of those having charge of standardization of wheels is to harmonize the wheel to the maximum conditions under which it must operate. Tables No. 1 and No. 3 are to be used exactly as tables for the strength of I-beams, channels, angles, etc.

Graphic Chart.—As a further aid in choosing wheels for various conditions, a chart has been prepared (Fig. 2) which extends beyond the limit of present freight cars. The object of this chart is to show in what classes of equipment brake pressures are likely to be in excess of safe wheel practice. Fortunately the cars at present under which the wheels are not properly standardized are comparatively few, and the remedy is easily applied.

The vast majority of wheels are properly standardized and the improper standards exist in a very small percentage of cars. This is all the more reason why these errors should be corrected. The total percentage of refrigerator cars is only 1.36 per cent.,

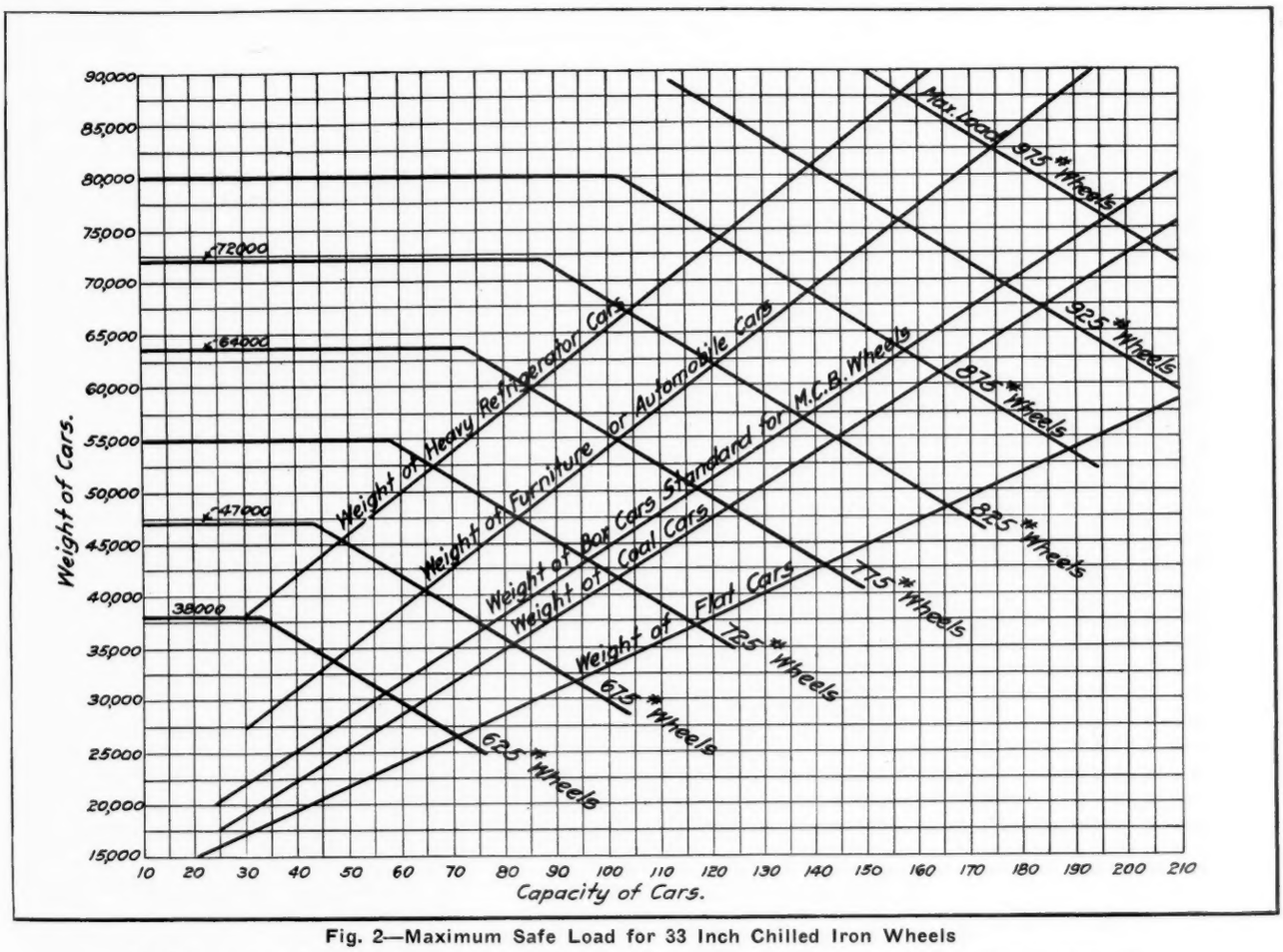


Fig. 2—Maximum Safe Load for 33 Inch Chilled Iron Wheels

Based on the Gross Load and the Temperature Stresses for Miscellaneous Equipment on Grades not Exceeding 3 Per Cent.

and there is probably about the same percentage of furniture cars. There are several ways in which corrections can be made. The recent tendency is to obliterate the different classes of cars by building a few cars of the smallest capacity, having largest brake pressure, thus placing these cars, as far as the wheel requirements are concerned, in the heavy class, and a wheel should be made to take care of all such non-standard cars.

WHEEL FOR HEAVY BRAKE PRESSURE AND SMALL LOAD.

This wheel would be the 625-lb. wheel with 75 lbs. added to the plates; in other words, what is needed is a heavy wheel with small center core size. The result of such a standard would be the practical elimination of wheel troubles in the important class of cars handling perishable freight where it is important that delays should not occur. If it should be impractical to have a standard wheel for refrigerator and heavy furniture

cars, then the alternative is to have but one wheel for all classes of cars. This would be far more expensive, as it would be necessary to increase the weights on 95 per cent. of the 60,000-lb. class of cars because 5 per cent. of this class require heavy wheels. It is not practical to use the present standard 675-lb. wheel for refrigerator cars for in the first place making the core size smaller would add at least ten pounds to the hub and the weight would then be 685 lbs. It becomes necessary, if the 675-lb. standard is maintained, to take ten pounds of metal from the plates. The tread of the 675-lb. wheel is much heavier than required for the gross load carried by refrigerator cars, hence the final result would be but a slight improvement over the 625-lb. wheel.

Another solution is to abandon the present 675-lb. wheel and use the 725-lb. under both 80,000 and 100,000-lb. cars, because in many cases there is no difference to speak of in these two classes, and better service would be secured in the 80,000-lb. class. The standards would be:

725-lb. wheel for 80,000-lb. and 100,000-lb. capacity cars.

700-lb. for refrigerator, furniture, and other heavy cars of the 60,000-lb. capacity class, and also for 70,000-lb. capacity cars.

625-lb. for ordinary 60,000-lb. and less capacity cars, and the lighter refrigerator cars.

This would be the best solution, as it would take care of all cars of the 80,000-lb. class which have a braking power in excess of that of the average 80,000-lb. class, such as refrigerator cars, furniture cars, etc. The 725-lb. wheel is correct for most 100,000-lb. capacity service. There are a few cases, however, of dairy products cars and special cars of very heavy weight which would require special consideration.

ENGINE TENDER WHEELS.

It is the custom with most railways to purchase the three weights of M. C. B. wheels and use them indiscriminately in freight, engine and passenger service, the only item considered being the weight of the wheel and size of journal. Fairly good results have followed from this practice on roads where brakes are seldom applied to prevent too high an acceleration of speed on descending grades, but on heavy grades where the conditions imposed on the wheel are greater than those ordinarily encountered in freight service for the same weight of wheel, special consideration is required. This subject has been given careful consideration during the last two or three years and designs have been developed which answer every service requirement.

In making up the designs for wheels in service under engine tenders the same relation to service conditions are followed as shown in Table No. 1, which is based upon the M. C. B. recommendations for freight service. The difference between engine tender service for a given gross load and freight service for an equal load is that the weight of the tender when empty is much greater than that of a freight car; because the tender is always partially loaded, the braking power is made at a higher percentage than is common in freight service, so that the temperature stresses in tender wheels are very much greater than in any of the cars in the same train; for example:

Let us assume a tender having a capacity of 8,000 gal., using an axle with 5½ in. x 10 in. journals. The items relating to the wheel problem are as follows:

Weight loaded	150,000 lbs.
Weight empty	56,000 lbs.
Brake pressure at 90 per cent.	50,400 lbs.

It will be noted that as far as the load is concerned an axle of the same dimensions used under 100,000-lb. capacity cars is sufficient and it is assumed by a good many roads that, therefore, the 725-lb. M. C. B. wheel is equally as satisfactory as in freight service. This conclusion may be approximately true on roads where there are no grades of sufficient consequence to call for continuous operation of brakes, but on roads having steep grades requiring brake action to control the speed of the train it can readily be seen that the condition is very different from that of wheels under freight cars.

It was shown that the 725-lb. wheel is designed for cars having approximately 30,000-lb. brake pressure. The problem resolves itself to the following:

Engine tender, braking power	50,000 lbs.
725-lb. wheel designed for braking power	30,000 lbs.
Excess braking power	20,000 lbs.
From Table No. 2, 725-lb. wheel has plate thickness.	1.06 in.
From Table No. 1, excess metal required for 20,000-lb. braking power	.25 in.
Thickness of plate required for tender wheel	1.31 in.
From Table No. 2 weight of 33-in. wheel, plate thickness 1.31 in.	825 lbs.

This shows that to obtain the same factor of safety under an engine tender having a gross load of 150,000 lbs., as in freight service, that an 825-lb. wheel is required. Wheels of this character will produce the best results.

Another reason why wheels for tender service require a larger section of metal in the plate is that many engines are equipped with straight air brakes which are used independently on the engine. Therefore it is possible to use the brakes on the tender wheels with greater frequency, or with greater intensity, than on the entire train. Also on account of the short wheel base and the high center of gravity of the load, there is more swaying and greater shifting of the load from one wheel to another than in ordinary service. This coupled with the desire to give a higher factor of safety in engine service demands a wheel in which all parts are proportioned to the stresses which are known to apply to the wheel.

Table No. 5.

Weight of Engine Tender Wheels.

Capacity, Gals.	Weight of Tank.	Total Load.	Thickness of Plates in Inches.	Weight of Wheels.	Size of Journal.
3,000	21,000	60,000	.68	600	3¾ x 7
4,000	28,000	80,000	.75	600	4¼ x 8
5,000	35,000	100,000	.87	650	4¼ x 8
6,000	42,000	120,000	1.00	700	5 x 9
7,000	49,000	140,000	1.12	750	5 x 9
8,000	56,000	160,000	1.25	800	5½ x 10
9,000	63,000	180,000	1.37	830	5½ x 10
10,000	70,000	200,000	1.50	860	6½ x 12

Weight of Engine Truck Wheels.

Diameter.	For Less Than 6,000 Pounds Pressure.	For 6,000 to 12,000 Pounds Pressure.	For 12,000 to 16,000 Pounds Pressure.
24 ins.	410 lbs.	450 lbs.	480 lbs.
26 "	460 "	500 "	535 "
28 "	510 "	560 "	600 "
30 "	575 "	635 "	680 "
33 "	650 "	735 "	800 "

Table No. 5 shows in general the weights of wheels which should be used in engine tender and engine truck service.

PASSENGER SERVICE.

A great many pasenger cars are equipped with our chilled iron wheels and no failure has been reported in years in regular passenger service.

Table No. 6.

Weight of Passenger Car Wheels.

Capacity.	Weight of Car.	Total Load.	Thickness of Plates in Inches.	Weight of Wheels.	Size of Journal.
8 Whl. Trk.	20,000	35,000	.68	600	3¾ x 7
8 " "	30,000	45,000	.68	600	3¾ x 7
8 " "	40,000	55,000	.81	625	3¾ x 7
8 " "	50,000	65,000	.93	675	3¾ x 7
8 " "	60,000	80,000	1.06	725	3¾ x 7
8 " "	70,000	90,000	1.18	775	3¾ x 7
8 " "	80,000	100,000	1.31	815	4¼ x 8
12 " "	80,000	100,000	1.00	700	4¼ x 8
8 " "	90,000	110,000	1.43	845	4¼ x 8
12 " "	90,000	110,000	1.06	725	4¼ x 8
8 " "	100,000	120,000	1.56	875	5 x 9
12 " "	100,000	120,000	1.12	750	4¼ x 8
12 " "	120,000	140,000	1.31	815	4¼ x 8
12 " "	140,000	160,000	1.43	845	4¼ x 8

The weight of wheels for passenger service is shown in Table No. 6. This is based largely on Table No. 1, although it is self-evident that the factors for passenger service are different than those for freight service in that the tonnage to be controlled by the brakes is less, and therefore, for continuous application of the brakes less braking power is required. However, as passenger trains require special factors of safety, the wheels should not be lighter than shown in Table No. 3 for 4 per cent. grades. Chilled iron wheels were used under the first Pullman coaches,

but as the coaches grew heavier the service became too severe for the then existing designs of chilled iron wheels, viz., 650 lbs. for 36-in. wheels, and inasmuch as there was no heavier design for the chilled iron wheel at that time, a change was made to the heavy steel-tired type of wheel. The service on passenger cars is not nearly so severe as in heavy freight and engine service, and therefore the chilled iron wheel, if of proper weight, is eminently adapted to this traffic as indicated by the large number of cars equipped with them in constant service year after year with no wheel failures.

SELECTION OF WHEELS FOR ENGINE AND PASSENGER SERVICE.

It is almost self-evident that wheels should not be purchased as freight wheels and used indiscriminately in engine and passenger service, for the reason that the operating stresses in the wheel are not the same in both cases. The process of selection is thoroughly recognized in all materials entering into the construction of passenger equipment and should be extended to the wheels, which are the most important part of the structure.

Large sums of money are spent to procure safety in other directions, while practically nothing is allowed the chilled iron wheel maker for producing the best that can be made for this service. Where it is known that wheels are ordered for passenger and engine service, special selection can be made in the foundry of the taps from which they are poured, special treatment in annealing and special tests after the manufacture has been completed can be applied.

The same rules apply here as in the manufacture of any other article. There is an opportunity for selecting from the mill run of any product in order to secure the most select for any special service. Also during the last two years considerable progress has been made in the use of alloys which can be shown to definitely improve not only the wearing quality but the stability of the wheel from structural failure. It is evident that where expensive alloys are used and where special manufacturing consideration is given to a lot of wheels that there must be an increase in the manufacturing cost. This, however, is very slight in most cases, and is returned to the railway in the way of extra service, extra guarantees, etc.

SAFETY.

The question of safety in the use of chilled iron wheels is often discussed. Safety is a relative term and whether one type of wheel is more safe than another depends on a careful record showing percentages of failures. The results in service show that no type of wheel is entitled to the distinction of being "absolutely safe" and when we begin to apply the percentage of failures, often the wheels that are supposed to be the most safe are compelled to relinquish this claim to some other type. Where the rules laid down in this article are followed, there will not be one broken wheel in one million in the chilled iron class. The study of the metallurgy of the chilled iron wheel shows the metal to be ideal for the purpose for which it is used, that is, the maximum amount of service and reliability at the least cost.

Considering the present misapplication of wheels in the case of cars of heavy braking power, as compared with their capacity, and in the adaptability of chilled iron to produce the best and at the same time the cheapest material for wheel manufacture, and on account of the reliability of the wheel when the relation of the metal to the stresses which it must safely carry is considered, we have no hesitancy in recommending the chilled iron wheel for all classes of railway service which now exist, and we see no indication of having reached the limit; in fact on account of the absence of ductility in the metal of the tread it is better suited than any other material for highly concentrated loads. For special cases, such as crane and turn-table service, where 100,000 lbs. are carried per wheel, we have no hesitancy in furnishing standard designs of chilled iron wheel.

From tests we have made, we are positive that if allowed a reasonable advance to permit greater care in manufacture and closer inspection on lines which are not now covered by standard inspection rules, and if the wheels are ordered specially for each class of service, as outlined in this paper, we can furnish not only the most economical, but the safest wheel made of any material, and guaranteed to stand any service that the strongest car or rail can carry, for any capacity or in any service, and that the proportionate ratio of comparative safety and wear will increase in proportion with the load.

INCREASING SHOP OUTPUT.*

SECOND PRIZE.

W. G. REYER.

General Foreman, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

Last May we started an effort to increase the shop output. The first move was to speed up the stationary engines, increasing the speed of the line shaft from 125 to 160 r. p. m. By using a heavier tool steel and forcing the cut on the wheel lathe, which was not of the latest type, the output has been increased from three and a half to five pairs of driving wheels in 10 hours. By increasing the feed on the planer and improving the device for clamping driving boxes, we have been enabled to reduce the time for replaning the shoe and wedge fit on two boxes from one hour to 20 minutes when ¾ in. or ⅞ in. of stock is removed, and after being laid off on the engine has been decreased from one hour to 20 minutes when ¾ in. or ⅞ in. of stock is removed, or 12 minutes when ¼ in. stock is to be removed. This is accomplished by the use of the chuck shown in Fig. 1. It consists of a bed plate C with three T-slots, the central one being used by the two T-bolts which hold the guide bar A in position. This guide bar is the same size as the frame jaw, so that the shoe and wedge fit over it snugly. There are two dogs D on each side of

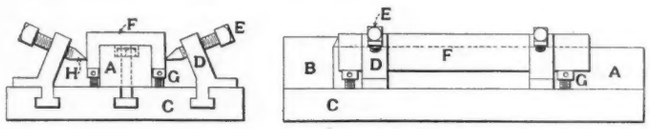


Fig. 1—Chuck for Planing Shoes and Wedges.

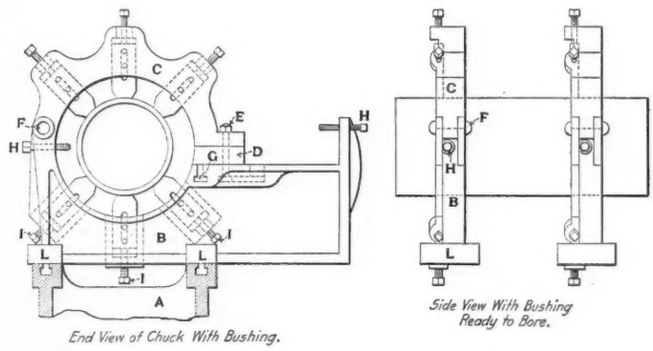


Fig. 2—Chuck for Boring Cylinders or Cylinder Bushings.

A and near its ends; the steel screws E which pass through the dogs are balled out at the ends to take the center points H, which hold the shoe firmly in position. The block B is made of tool steel, the top of it coming in contact with the shoe, as shown. The shoe is set on the guide A and may be adjusted by turning the roundhead screws G; the heads of these screws have six 5/16-in. holes and are turned by means of a pin 7 in. long, made of hard steel wire, tapered at one end to enter the holes easily. By means of this device it is possible to adjust a shoe or wedge in from one and a half to two minutes and to hold them securely under any feed or depth of cut.

*This article was submitted in the competition which closed December 15, 1910, and was awarded the second prize of $20.

By using a square nose tool and taking a coarser feed and heavier cut we have been able to reduce the time for finishing strap rod brasses from 3½ to 1½ hours for the smaller sizes, and from 5½ or six hours to 2½ hours for the larger ones. We used to turn our driving box brasses on a lathe, requiring 30 minutes. They were then laid off and fitted in to be planed, requiring 25 minutes, and about 25 minutes more for planing. This work is now done on a draw cut shaper, and the brasses are finished and ready to apply to the driving box in about 30 minutes for the smaller sizes and 45 minutes for the larger ones. It formerly required 12 hours to bore an 18-in. cylinder, this time being measured from the time the cylinder was taken off the floor until it was returned. This is now being done in nine hours, and the time will be reduced still more when the chuck shown in Fig. 2 has been installed. A is a section of the bed of the cylinder boring machine, and B is the base of the chuck, which may be used either for a cylinder bushing or a cylinder casting. The method of chucking one of the bushings is clearly shown in the illustration. To use this chuck with a cylinder it is necessary to remove the part C by taking out the bolt E and removing the block D and the pin F. The cylinder may then be placed on the base and adjusted to the proper position by manipulating the screws I and H. The casting may be securely clamped in position by means of two cross bars, one at each end of the cylinder, one end of the bars being held by eye bolts which fit on the pins F, and the other by T-bolts, which fit in slots G. The lugs L are bolted to the base of the machine by two bolts each.

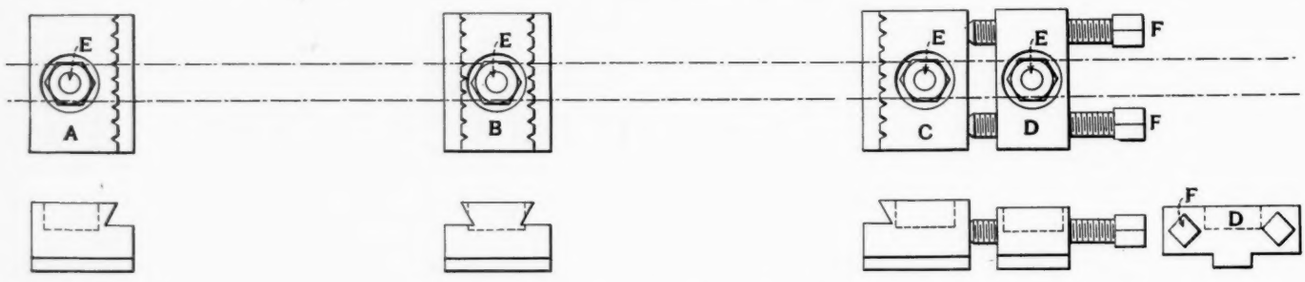


Fig. 3—Chuck for Milling Shoes and Wedges.

By using heavier tools and coarser feeds we have reduced the time for turning rod bushings on the lathe from one-half hour to 15 minutes. In the lathe it is the coarser feed and not the speed that counts. Formerly we turned our cylinder packing, of Stevenson style, on a lathe. By doing this on a boring mill we have been able to cut the time in half, turning out 30 rings in 10 hours. However, we are now installing Dunbar packing and are able to finish 10 rings in 10 hours.

We finish all shoes and wedges on a milling machine, machining both the inside and outside at one operation. One man will finish 40 of these in 10 hours. The chuck for milling shoes and wedges is shown in Fig. 3. The blocks A, B, C and D are made of cast steel and have tongues which fit in the grooves in the table of the milling machine. The blocks are held in place by the bolts E. The shoes are placed between the upper parts of the blocks and these are then forced tightly against the ends of the shoes by screwing up the set screws F in the tail block D. The shoes are milled at the top and sides in one operation. By changing the clamping device and forcing the cut for boring out driving boxes, we have been able to decrease the average time of boring these boxes and facing the hubs for from 6-in. to 9-in. journals from 1½ hours to 50 minutes. Five-inch strap rod brasses, which we formerly bored and faced on a lathe, requiring about 1½ hours, we are now able to finish on the boring mill in one hour. Formerly it was the practice to have two men on double-head bolt cutters. One man now attends to both heads, and we have increased the speeds for a ½-in. bolt from 122 to 200 r. p. m.; for a ⅝-in. bolt from 74 to 180 r. p. m.; for a ¾-in. bolt, 70 to 150 r. p. m., and for ⅞-in. and 1-in. bolts, 68 to 122 r. p. m. We also use high speed steel dies. One man has turned a thread for 2½ inches on ⅞-in. bolts at the rate of 160 in 30 minutes. Note that we are cutting the 1-in. bolts at the same rate formerly used for ½-in. bolts.

ERECTING SHOP.

The erecting shop was so crowded that we did not have adequate space to assemble brake work, spring rigging, pistons, crossheads and rocker boxes. Two pits were closed and used for this work, leaving 13 working pits. We were not using specialists on all work except steam pipe and brake rigging. One machinist and two apprentices remove all steam chests, fit all valve yokes, lay off new valve rods, fit new valves and valve strips and rings, face all valves and apply steam chests. One machinist and one apprentice do all the guide work. One machinist, an apprentice and a helper attend to the crossheads, pistons, cylinder packing and glands. Two handy men and one helper overhaul and apply all brake rigging and spring rigging, reaming all holes necessary for this work. Two machinists and two apprentices attend to the eccentrics and eccentric straps, apply the link motion and set the valves. One machinist and one apprentice remove, overhaul and apply the reverse levers and quadrants. One machinist and one helper face all frame jaws and apply the binders. One machinist and one apprentice lay off all shoes and wedges, fit up new ones and apply liners to the old ones. Three handy men and three helpers do the work on steam pipes, dry pipe, stand pipe and throttle rigging. One machinist is employed for cab work. A foreman and 12 helpers deliver all material, and when not engaged in this work, clean the shop. Each man in the erecting shop has a work box on a two-wheel truck, thus saving considerable time. Air hammers have been installed for doing all chipping.

We cast the brass on the shoe and wedge fits of both steel and cast iron driving boxes and also on the hubs. The boxes are not heated before the brass is poured. The arrangement for preparing the driving boxes for pouring the brass is shown in Fig. 4. The block D is placed in the box and the ring E, which forms the hub liner and which is 1 in. wide, ⅜ in. thick and of a diameter to suit the box, is placed in position, the block D projecting ½ in. above it, as shown in the illustration. The crown of the box is dove-tailed to hold the brass securely, the grooves H H crossing in the center and extending to within ¼ in. of the flange. Strips G are then clamped at the ends and the joints are luted with clay or asbestos. Attention is directed to our method of reclaning old driving boxes. Before we started applying the brass liners on the shoe and wedge fit we would scrap the box when it had been planed down to a certain limit. Now we plane the box to the limit and then pour a brass liner on it and use it again. This refers to cast iron boxes. The practice of casting liners on the steel driving boxes instead of riveting saves about $1.50 in labor on each box. We are welding our broken frames with crude oil without removing them from the engine.

We have a meeting of all of the foremen once a week, at which they are expected to report progress on the work in their departments for engines which are in the erecting shop and to state when they will be able to complete the work on each one of them. We then set a time at which each engine must be

turned out of the shop. If the foremen are short of facilities, or any other department is holding them up, they report it.

BOILER SHOP.

It formerly required about 170 hours to apply a back flue sheet and a side sheet to one of our consolidation locomotives. We have reduced this to 88 hours by handling the work in the following manner: A boiler maker and helper start to remove the flues, this work being completed in about six hours. Two drills are then started on the outside and a man begins to cut off the rivets on the flange and mud ring. An operator with an oxy-acetylene torch cuts the seams. The staybolts are broken down in the throat and by this time the drilling of the staybolts has been finished. The flue sheet is then knocked out and we start to drive the bolts back. A turn-buckle is applied which helps to pull the bolts loose. This part of the job is accomplished in about 14 hours. The sheets are then laid off, punched and placed in the boiler. The flue sheet is marked off, after which it goes to the punch. We then start riveting on the side sheet, beginning at the mud ring and working up the flange and across the seams. This is ordinarily completed in from eight to 10 hours. The flue sheet is then applied and riveted in place. All rivets are driven with a long stroke hammer. The stay-bolt taps are then started and the bolts are applied, the chipping and calking being done in the meantime. The boiler is ordinarily ready for the flues 88

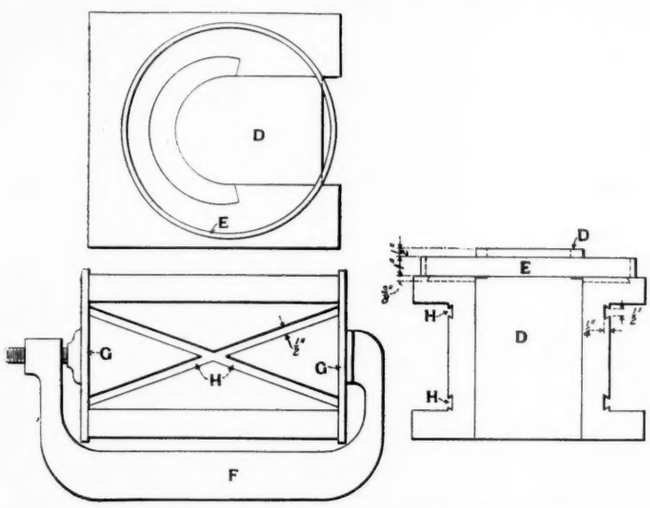


Fig. 4—Driving Box Ready for Pouring Brass.

hours after the work is started. During the month of November, 1910, we turned out 18 engines from the erecting shop.

APPRENTICES.

We have installed an apprentice school, having 48 apprentices, divided into six classes. Each class attends school for 2 hours in the early morning, from 6:50 to 8:50, and again from 12:20 to 2:20 P. M. once a week. This arrangement of time allows each class to get one morning turn and one afternoon turn during the week. They are taught mechanical drawing, arithmetic and spelling, and show a great deal of interest and are already showing ability and progress.

FOREIGN RAILWAY NOTES.

According to the German press, it was resolved at a recent meeting of the principal storekeepers of Russian railways, that steps be taken to procure the repeal of the order prohibiting the use of foreign material. It was pointed out that in spite of the existing regulations, foreign material is imported. Hence the railway authorities have to pay a heavy price to the agents for material, which could be procured directly at much less cost. Among other things it was proposed that the import duties should be reduced.

HOW TO GET THE MOST WORK FROM MEN AND MACHINES.*

BY C. J. CROWLEY.

Piece Work Inspector, Chicago, Burlington & Quincy, West Burlington, Iowa.

This is a problem that all shop managers are striving to solve. I find that when you have men working on one class of work they become experts and can do much more work in a given time than mechanics, no matter how good, can do in the same time if they are not accustomed to the work. In equipping a shop it is best to have two or more machines exactly alike, set side by side. Of course, you can not do this with all machines, but where it is possible it should be done. The advantage is that you can arrange the work to always have a mechanic available for any job that is needed. If a mechanic is sick or is taking a vacation you do not have to assign a man to work that he is not accustomed to. When it is advisable to make attachments or jigs, it is only necessary to make one as it can be used on either machine. When two or more mechanics are working on the same work they naturally talk it over, and it also establishes a sort of rivalry between them which means better work and more of it. It is an advantage in working in apprentices, as they always have an experienced mechanic near by to instruct them. The apprentice learns much more quickly and the company is the gainer.

When an apprentice is working on a machine, let him know its condition, and tell him that you would like to have it in as good or better shape when he is ready to leave it. You will thus turn out mechanics that are always trying to better conditions, and instead of letting their tools run down they will improve them. Work that requires a skilled mechanic should be separated as much as possible from that which can be done by an apprentice or a handy man.

Parts of engines should be put through the machine shop in as large quantities as possible, as it is much cheaper and increases the output. Avoid as many changes of work on machines as possible, as the time lost in making them lessens the output of the machine. When an engine is in the shop for repairs have a date or the time when it is expected out; then the mechanics working on certain parts will know just when each part is needed, and will try to have the work done promptly so they will not be blamed for the delay.

Templates should be used for laying out work and for drilling, thus securing greater uniformity and a larger output than when holes are layed out separately. The use of high speed steel has increased the output of machine tools 100 per cent. over the old carbon steel. High speed drills are being used more each year, but when large holes have to be drilled or reamed, they are rather expensive. Free cutting reamers with soft steel bodies and high speed cutters are cheap and do the work as well as high priced drills and at about one-third the cost. With reamers of this kind you can increase the output at least 100 per cent over the carbon steel reamer, and the holes are more uniform than those made by a drill.

During the past few years the tendency of tool builders making tools for railway shops has been to make heavy, powerful, complicated machines. In a few cases the powerful machines are all right, but in many instances these machines are running about 75 per cent. of the time on work that does not need much power or an extra heavy machine. As the heavy, powerful machines are usually clumsy, nothing is gained by their use. What railway shops need is a heavy, powerful, hollow spindle turret lathe that will take old axles and rough out crank pins, crosshead pins and rod knuckle pins, etc., cheaper than the cost of forging. These pins can then be finished on any ordinary lathe much cheaper than the forged pins.

In most old shops lathes, planers and drills are in fair shape,

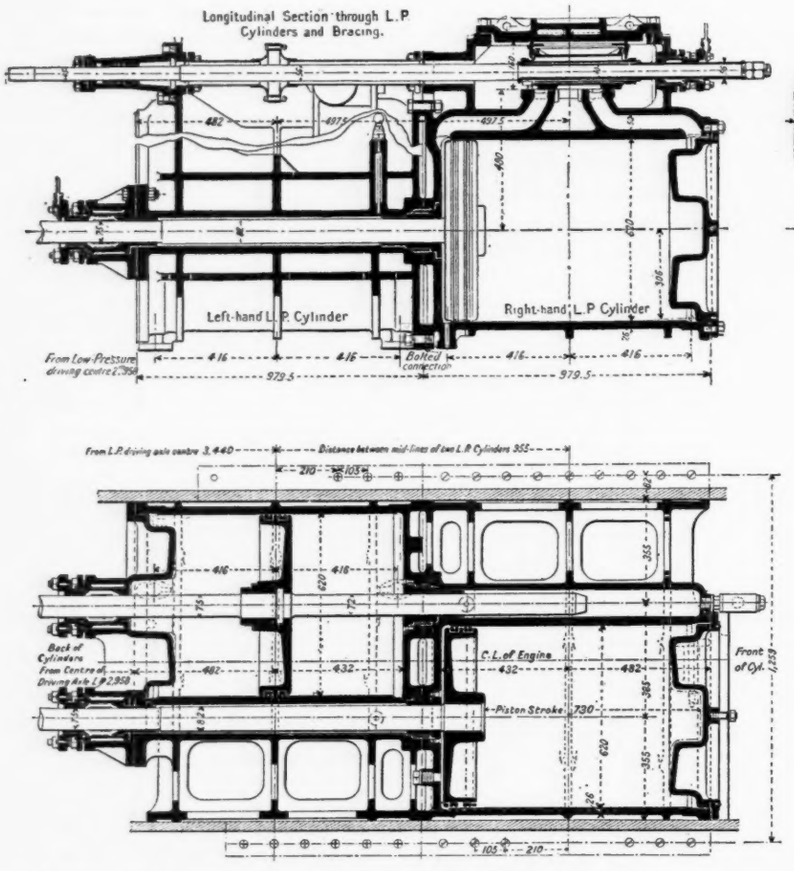
*Submitted in the competition which closed December 15, 1910.

but have not the belt pulling power to compete with modern machines. Wider belts can often be used to advantage on them On a machine having a four-step cone a two or three-step cone can be made to fill the space, increasing the power which can be transmitted greatly.

All castings and forgings should be watched to determine if they have a surplus of stock or require unnecessary work.

To get the best results, either in the building of new engines or in repair work, three or more men should work on the same class of work. In the smaller shops these men will have several different jobs to do. When an engine is in the shop for repairs part of the men can do the stripping while the others are assembling the work on other engines. When it is necessary to break in a new man it is much easier when he has three or more men who are capable instructing him.

A system of accounting should be established by all railways for different classes of repairs, such as air brakes, boiler shell, boiler trimmings, driving boxes, driving wheels, etc., such that it will be an easy matter for one road to compare its work with another. When the cost of a certain class of work is high, as compared to other roads, an investigation should be made to determine the cause. The mechanics would be more careful and not put in too much unnecessary time on their work. They should be taught to do good work where it is necessary and to cut out all unnecessary work. The mechanic of today is not the man that can do a good job, but the man that knows when a job is "good enough."


Longitudinal Section through L.P Cylinders and Bracing.
Left-hand L.P. Cylinder
Right-hand L.P Cylinder
Bolted connection
Section through L.P. Cylinder.
View at back of L.P. Cylinder.
Between Frames 1"090
Back of Cylinders From Centre of Driving Axle L.P 2.850
C.L. of Engine
Front of Cyl.
Piston Stroke 730

Arrangement of Cylinders on the Baltic Type Locomotive for the Northern Railway of France.

The Trans-Andean Railway, connecting Valparaiso, Chile, and Buenos Aires, Argentina, ascends the Andes 7,615 ft. within a distance of 46 miles from Los Andes to the summit, or an average of about 166 ft. to the mile.

STEPPED CYLINDER ARRANGEMENT FOR BALTIC TYPE LOCOMOTIVE.

The demand for more powerful locomotives for the Nord express, running between Paris, Brussels, Cologne and Berlin, together with the desire to use four-cylinder compound locomotives having slab frames and limited lateral clearance, has led to the ingenious design for the inside cylinders which is here illustrated. This design is used in the new Baltic type locomotive, 4-6-4, which is now building at the shops of the Northern Railways of France. It will be the most powerful passenger locomotive in Europe and is expected to develop 2,000 h.p. The specifications require it to haul 441 tons of train, at an average speed of 75 miles an hour on a level, or at 60 miles per hour on ½ per cent. grades.

The dimensions of the compound cylinder will be approximately: High pressure, 17¼ in. x 25¼ in.; low pressure, 24.8 in. x 29.2 in.; driving wheels, 80¼ in.; boiler pressure 227 lbs. The maximum tractive effort working simple will be 42,746 lbs., and working compound 32,360 lbs. The total weight of the engine loaded will be 225,000 lbs., and the weight on drivers 120,000 lbs. The engine will have a superheater, with a superheating surface of 667 sq. ft. a steam generating surface of 3,898 sq. ft., making a total of 4,565 sq. ft. The novel feature of the locomotive is the arrangement of the inside cylinders one in front of the other, or, "stepped," as it is termed. The space between the slab frames of European locomotives is only about 40 in., and with this new design it is possible to use two inside cylinders, 30 in. in diameter, thus giving a large ratio of cylinder diameters. It permits the construction of more powerful compound locomotives of the four-cylinder type and allows the use of larger cylinders, which is regarded as desirable for superheated steam. The main rods are of equal length, so that there will be no tilting action due to the offset cylinders, as far as the rods are concerned. This new locomotive will be tested in competition with one which is being built at Creusot, having the same proportions but fitted with a water tube boiler built on the Temple system of steam generation as employed in the French navy. We are indebted to *The Engineer,* London, for the illustration of the new cylinder design.

The first train composed of all steel rolling stock to operate on an English railway of standard gage, made a trip on the Metropolitan District Railway on January 3. It is expected that within two months 52 all steel cars will be in service on this line. These trains will be composed of alternate motor and trailer cars, and will be equipped with the Westinghouse quick action air brake.

General News Section.

A. J. Davidson has been appointed commissioner of the Pacific Northwest Demurrage Bureau, Seattle, Wash., in place of R. Dudgeon, deceased.

At Douzy, France, January 26 Roger Sommer, flying in a biplane at a height of 100 ft., carried six passengers to Romilly and back.

Mayor Gaynor, of New York City, is having prepared a bill, to be presented to the legislature, to provide for the construction of a freight railway along the west side of Manhattan Island, in accordance with the plans which have been proposed by Dock Commissioner Tomkins.

The Chesapeake & Ohio has ordered telephone equipment for its lines through from Fortress Monroe to Cincinnati, nearly 1,000 miles. Since last March the telegraph has been supplanted for train dispatching over four of the most important divisions of this road, and the telephone system is now complete from Richmond to Cincinnati by the James river route. The equipment is furnished by the Western Electric Company.

The State of Maine must be added to the list of states, already somewhat long, in which it is proposed to greatly enlarge the powers of the state authorities over railways. A bill has been drawn for the establishment of a Public Utilities Commission of five members and it is said that United States Senator Johnson is one of its authors. A joint caucus of the democrats (who are now in the majority in the legislature) has declared in favor of the bill. Massachusetts is also agitating the subject.

A robber who held up the passengers in a train of the Colorado Southern, near Pueblo, last Friday, in broad daylight, and who secured $117 in money, together with some jewelry, was caught a few minutes after he leaped from the train. Special Agent McCafferty, of the Denver & Rio Grande, who happened to be on the train, and who was informed that the robber was at work in the rear coach, followed him in jumping off the rear platform, and succeeded in shooting the thief through the right wrist, thus compelling him to drop his pistol.

J. A. D. McCurdy, who on Monday last in a biplane attempted to fly from Key West, Fla., to Havana, Cuba, succeeded in flying about 96 miles and almost reached land, but was compelled to alight on the water because of the accidental loss of a part of his lubricating oil. He was picked up by vessels of the navy which were watching for him. He succeeded, however, in making the longest flight in America, the longest over-sea flight anywhere, and the first sea flight out of sight of land. He was in the air two hours and eight minutes.

The annual report of the insurance department of the Pennsylvania Railroad system shows that the company's losses by fire in 1910 were $280,097, as compared to $402,615 in 1909—a reduction of almost a third. In the past few years the road has redoubled its efforts to prevent fires. Many employees have been trained in fire fighting, and there are organization of firemen in every station, roundhouse and shop. Many yard locomotives have been equipped with pumps for fire fighting. In 1910 379 fires on company property were extinguished with the company's fire apparatus and by the company's own employes, with only a loss of about $18,000. The Railroad Insurance Department is to issue a circular to employes calling attention to the number of fires occurring from preventable causes. There were 1,009 fires on the system last year, and the loss from them was only $280,097, an exceedingly small loss, as the value of the property on which they occurred was more than $250,000,000. Thirty-six fires entailing a loss of $17,000 started on adjacent property. Sixteen fires, with a loss of $16,750, were of incendiary origin.

Railway Accidents in Pennsylvania.

The statistics of persons killed and injured on the railways of Pennsylvania, as tabulated by the railway commission of that state, are of interest by reason of the arrangement of the classes of employees, which is different from that found in most statistical reports. We quote as follows:

During the year 1910 there were 1,364 persons killed and 14,083 injured on the steam and street railways of Pennsylvania. On the steam railways 1,117 lost their lives; on the street railways, 187. The roll of injured shows that 9,967 were hurt on the steam railways. Trespassers were the most frequent victims, 587 being killed. The statistics of employees show the following:

	Killed.	Injured.
Section men and work train employees	120	1,352
Brakemen	112	2,490
Firemen	33	964
Conductors	31	578
Flagmen	21	213
Repairmen and inspectors	21	168
Track walkers	18	27
Yard crews	16	341
Engineers	10	528
Crossing watchmen	5	14
Carpenters	4	126
Freight handlers	3	580
Baggagemen	2	75
Car cleaners	1	83
Miscellaneous	40	469
Total	437	8,008

Of the total fatalities (1,177), 44 were killed in collisions, 85 at grade crossings, 28 by derailment; . . . struck by overhead or side obstruction, 17; repairing track or roadbed, 4; handling freight or baggage, 3; coupling or uncoupling cars, 15; falling from locomotive or cars, 111; jumping on or off locomotives or cars, 77; struck by locomotives or cars, 728; miscellaneous, 46.

It will be observed that though the total number of section men and work-train employees killed was 120, the number killed in repairing track was only 4; indicating apparently that the greater part of the 120 fatalities happened when the victims were not actually at work.

Earnings of United States Steel Corporation.

The statement of the United States Steel Corporation for the quarter ended December 31, was far below expectations in earnings, which were reported as $25,990,978. This was at the rate of approximately $104,000,000 a year, a figure barely in excess of dividend requirements at the rate of 7 per cent. on the preferred and 5 per cent. on the common, and other annual deductions. Surplus net income for the quarter, after all deductions, including sinking funds, depreciation and dividends, was only $408,032, or at the rate of approximately $1,600,000 a year. The annual dividend requirements on common stock of the corporation amount to approximately $25,000,000. From the foregoing figures it is evident that the earnings for the last quarter of 1910 were only a shade in excess of common dividend requirements. The total earnings of $25,990,978 for the quarter ended December 31 compare with earnings of $40,982,746 in the last quarter of 1909; $26,246,674 in the last quarter of 1908. The net earnings in the fourth quarter of 1910 were lower than in any previous quarter since the organization of the corporation, with the exception of 1903 and 1904. Earnings by months from October to December, inclusive, reflect the depressed condition of the steel industry in that quarter. For example, earnings in October aggregated a total of $10,512,000; November, $8,228,000 and December, $7,249,000. The unfilled orders on hand at the close of December 31, 1910, amounted to 2,674,757 tons as compared with 5,927,031 tons on hand, December 31, 1909. After the meeting Judge Gary gave out the following statement: Thomas Morrison, of Pittsburgh, tendered his resignation as a member of the board of directors, thereby creating a vacancy and in his place we elected James A. Farrell. Also we accepted the resignation of W. E. Corey as president and elected to succeed him Mr. Farrell.

Proposed Improvements at Boston.

The Joint Board of Metropolitan Affairs, including the Railroad, Harbor, and Public Land, Boston Transit and Metropolitan Park Commissions, reporting to the Massachusetts Legislature, recommends a tunnel between the North and South terminal stations (as proposed by the New Haven road), the construction of a new highway over the proposed tunnel, development of the East Boston flats, larger piers, and better railway and steamship

terminal facilities in South Boston, a large number of improvements in the metropolitan district, and various improvements in the Charles River basin. In its recommendations regarding a tunnel between the terminal stations the report says that the cost of taking 158 estates, which fall in the line of the proposed highway, will total $9,885,750. The report declares against recommending legislation for the electrification of steam railways; but a strong minority, including the railroad commissioners and George G. Crocker, former railroad commissioner are said to have been in favor of taking action looking to compulsory electrification.

World's Production of Steel.

The following tables were compiled by the British Board of Trade to show what part each country took in the world's output of steel in 1909:

Country.	Total production 1909. Tons.	Per head. Tons.
United States	23,955,000	0.27
Germany	11,856,000	0.18
United Kingdom	6,610,000	0.15
France	3,020,000	0.08
Russia	†	†
Austria-Hungary	1,909,000	0.038
Belgium	1,606,000	0.22
Canada	685,000*	0.10*
Sweden	308,000*	0.06*
Spain	223,000*	0.011*

* Provisional figures. † Figures not yet available.

United States.

Description of steel produced, in thousands of tons.	1907.	1908.	1909.
Open hearth:			
Acid	1,270	696	1,077
Basic	10,279	7,140	13,417
Total	11,549	7,836	14,494
Bessemer:			
Acid	11,668	6,117	9,331
Basic	.....	.....	.....
Total	11,668	6,117	9,331
Other sorts	146†	70†	130†
Total output	23,363	14,023	23,955

† Chiefly crucible steel.

Germany.

Description of steel produced, in thousands of tons.	1907.	1908.	1909.
Open hearth:			
Acid	209	145	225
Basic	3,975	3,792	3,782
Total	4,184	3,937	4,007
Bessemer:			
Acid	381	368	149
Basic	7,097	6,406	7,397
Total	7,478	6,774	7,546
Other sorts	208*	296*	303
Total output	11,870	11,007	11,856

*Steel castings, also crucible and electric steel in 1908.

United Kingdom.

Description of steel produced, in thousands of tons.	1907.	1908.	1909.
Open hearth:			
Acid	3,385	2,579	2,763
Basic	1,278	1,238	1,385
Total	4,663	3,817	4,148
Bessemer:			
Acid	1,280	907	1,111
Basic	579	572	622
Total	1,859	1,479	1,733
Other sorts	.....	45	729‡
Total output	6,522	5,341	6,610

‡ Mild steel.

The Commerce Court.

The senate on Tuesday last confirmed Messrs. Hunt, Archbald, Mack and Carland, as judges of the Commerce Court. This long delay on the part of the senate has been due to the fact that opposition was made in the committee against Judge Hunt, on the ground, it is said, that senators had found fault with some of his decisions as judge in Montana, but there was no opposition when the vote came to be taken in the senate. Judge Knapp was confirmed before the holiday recess, so the court can now organize.

Railway Securities Commission at Chicago.

The Hadley commission on the regulation of the issuance of railway securities finished its hearing in Chicago late last week. George M. Reynolds, president of the Continental and Commercial National Bank of Chicago, favored federal rather than state regulation of securities. He said responsibility for successful railway enterprise should be borne by the investor, but he should have the advantage of enforced publicity of railway affairs. Railway undertakings, because of their beneficial influence on the sections they serve, should be given some latitude for increasing by good management their earnings above the general level, but less latitude than they have had in the past. The reasonableness of railway rates should be measured by some standard other than return on capitalization. Railways should share seasons of depression as well as of prosperity with other concerns. Railway securities are becoming more widely distributed in the West than ever before, Mr. Reynolds said, and if the West continues to be as prosperous in the next 25 years as it has been in the past 25 years, its people will participate as largely in the prosperity of the railways as those of the East. He did not think that railway securities will be popularized by limiting the roads to any given financial return. He thought it would be a difficult thing to regulate the prices at which railway securities should be sold, as the price at which they are acceptable to the public depends on supply and demand. Moreover, usually a railway built through a section which needs a railway cannot sell its securities at par, and, nevertheless, it contributes more to the section than is represented by the difference between the par value of the securities and the cash actually paid in for them. Many railway difficulties would be solved if the government would restrict the building of new lines to territory where they are needed, but this might be taken by the investing public as a guarantee of the soundness of enterprises which were approved of, and the government should not put itself in the position of giving any such guarantee.

Rufus C. Dawes, president of the Union Gas & Electric Company, defended the issuance of so-called "watered" stock as a necessary means to promoting many enterprises. Speaking of public utility corporations in general, Mr. Dawes said that he thought the government was justified in restricting their earnings to a fair return on the value of the property, but that he did not think the government should interfere to determine how the fair return should be divided between the capitalists participating in the enterprise. He used this illustration: Suppose the cash investment in a property is $75,000. The return on this at 6 per cent. would be $4,500. Suppose $50,000 of the investment is represented by bonds drawing 4 per cent., or $2,000 a year; $25,000 by preferred stock, paid for, like the bonds, at their par value; and $25,000 represented by common stock, issued as a bonus to the persons without money but possessing brains who are relied on to make the business successful. It would be said that $25,000 of this capitalization was watered. But Mr. Dawes pointed out that 4 per cent. on the bonds, 5 per cent. on the preferred stock and 5 per cent. on the common stock would total just $4,500 a year, or 6 per cent. on the actual cash investment of $75,000. The public, therefore, in the charges which it paid, would be allowing the investors and promoters only an average return of 6 per cent. on the actual investment, and he could not see that the public had any particular interest in the fact that some of the investors voluntarily accepted only 4 per cent. on their cash investment and others got 5 per cent. on no investment at all except ability. Mr. Dawes said: "I think the abolition of unpaid stock would impede the organization of corporations and impair the efficiency of their operations. I think it would also withdraw an opportunity heretofore held out to ambitious and enterprising men without money.

"If the duty of warning the public purchasers of stocks appears paramount, and it is believed their interest would be protected by such action, stock could be issued to an amount equal to the cash paid in and the companies permitted to issue additional stock without designating money value, but conferring on the possessor a fractional interest in the equity above the stock having a designated money value.

"This would perhaps clarify the situation. It would certainly fix the attention of purchasers to the essential interest purchased—namely, a proportionate part of the whole.

"Since the government exercises the power of regulation, and

since the government cannot guarantee earnings, the government must not interfere more than is necessary in the manner by which capital is attracted to enterprises.

"If it interferes in a manner to check the flow of capital to railway investment the cost of operation will increase and the power of regulation will not suffice to prevent the rise of freight rates."

John J. Mitchell, president of the Illinois Trust & Savings Bank, and a director in four railways, favored federal rather than state regulation of securities. He opposed forbidding roads to sell their stock below par, because the amount securities will bring is a matter of the credit of the road, the value of the security and the rate of interest.

Burton Hanson, general solicitor of the Chicago, Milwaukee & St. Paul, favored federal regulation of securities and said he was not sure but what it was entirely practicable. He said that if the issuance of securities by interstate carriers comes within the right to regulate interstate commerce he thought Congress could exercise that power to the exclusion of the states.

John H. Roemer, a member of the Wisconsin railway commission, declared in favor of federal in preference to state regulation of both railway securities and railway rates. He said that Wisconsin would not let states' rights interfere with federal regulation.

Charles G. Dawes, president of the Central Trust Company of Illinois, favored federal regulation, but opposed regulation which would prevent securities from being issued for less than par. He insisted that capitalization had actually nothing to do with the fixing of rates. He said:

"Watered stock is not only not necessarily unfair between stockholders but is often essential to the complete fulfillment of fair arrangements between them. This device, harmless and often necessary in itself, has, through its association with efforts of corporations and individuals to dispose of stocks at fictitious prices, come to be widely condemned. So immensely large is the volume of watered stock in this country, issued alike by large and small corporations, that it would seem even to a prejudiced observer that it must subserve at least some good uses, because if it were wholly wrong it would be inconceivable that business men should so generally sanction it. Stock in the modern corporation represents not only ownership, but the location of control. Varying values in corporation assets are reflected in the selling or market price of the stock. Dishonest men may and do to some extent use watered stock to create impressions of values which do not exist, but the abolishment of watered stock would not materially hinder them.

"The proposed laws to reform corporations should not interfere with capitalization except to prevent fraud, and fraud is not inherently involved in watered stock. They should recognize that appraisement of property through stock issues does not mean realization on them. It is not the water in the stock that causes the chief trouble among the unwary investors. It is the water in the price they pay for it."

John Moody, of New York, said that "capitalizing American prosperity had put the railways between the devil and the deep sea." If a fundamentally sound system of financial management were adopted forthwith it would make necessary an immediate charge of higher freight rates if dividend payments were not to be impaired. He said the roads are inflating capitalization on a basis of present earning power, and if they continue to do this they will be "up against it" in the course of a few years. While the Interstate Commerce Commission prescribes excellent methods for keeping accounts, providing for the setting aside of a depreciation account for the constant renewal of wornout property, it does not have the power to force the roads actually to set aside such a fund. As a result, the roads generally are not paying much attention to the requirement. The tendency is to buy equipment with new capital and this unnecessarily increases capitalization. He said that if the Interstate Commerce Commission did not insist on full compliance with the requirement for putting aside adequate renewal sums out of earnings and the expenditure of sufficient funds from earnings for proper maintenance, the strong roads would pay less dividends, the weaker roads would be financially embarrassed and some probably would be driven into bankruptcy.

W. D. Williams, a member of the Texas railway commission, opposed federal regulation of railway securities. The states, he said, are in a better position to regulate the railways than the national government. Mr. Williams was confident watering of stock is harmful to railways and the public, but he is opposed to the federal government preventing it.

The discussions contributed by Frank Trumbull, of the Chesapeake & Ohio, and W. H. Williams, of the Delaware & Hudson, are given elsewhere in this issue.

Proposed Railway Legislation in Illinois.

The text of the bill for the amendment of the Illinois railway commission act, which has the backing of Governor Deneen, has been made public. The bill gives the railway commission jurisdiction over all common carriers and the term "common carrier" is made to include railways, express companies, steamship lines, private car lines, sleeping car companies, fast freight lines and all other persons or corporations engaged in operating any agency for public use in the conveyance of persons or property. The term "transportation" is made to include not only the actual act of transportation but all services performed in connection with it, such as refrigerators, storage, etc. The commission is given substantially the same jurisdiction over state business that the Interstate Commerce Commission has over interstate business, and, in addition, the regulation of security issues is provided for by the following provision:

"Sec. 14. No increase in the capital stock or the bonded indebtedness or any fixed indebtedness by any common carrier shall be created without application first being made to said commission. Upon said application being made the commission may employ competent experts to investigate the character, cost and valuation of the property of such common carrier and its present indebtedness and liabilities and the necessity for the proposed increase of capital stock or bonded indebtedness or other liability, and after such investigation shall determine whether or not such stock shall be issued or such bonded debt or other liability be created.

Quebec Bridge Loss $7,154,987.

The total cost of the wreck of the Quebec Bridge was disclosed in Parliament, at Ottawa this week. The cost of the wreck to date was stated by the Minister of Railways to be $7,154,987, but he estimates that the value of the unused steel on hand is $300,000. He said also that a number of bids for the new bridge had been submitted, but that it was not in the public interest to disclose them at present. There is a difference of opinion existing among the members of the new bridge commission, who have agreed to submit their differences to M. J. Butler, of the Dominion Steel Corporation, and W. H. Hodge, of New York.

The Railway Appliances Association.

A supplementary list of exhibitors at the exhibition of railway appliances to be given by the Railway Appliances Association during the week of the convention of the American Railway Engineering and Maintenance of Way Association, March 20 to 24, in addition to the list published in the *Railway Age Gazette* of December 16, page 1158, is given below. The available space is almost entirely reserved, but a few good locations are still vacant on the balcony. A working model of the Brennan monorail system will be in daily operation on a cable over the balcony, and it is expected that this will prove one of the most novel and interesting features of the exhibit. The exhibition this year will be larger and will contain more interesting features than any held in previous years.

American Railway Steel Tie Co., Altoona, Pa.
Burroughs Railway Nut Lock Co., Decatur, Ga.
Ceresit Waterproofing Co., Chicago.
Chicago Pneumatic Tool Co., Chicago.
Philip Carey Company, Cincinnati, Ohio.
W. P. Collins & Co., Chicago.
Concrete Form & Engine Co., Detroit, Mich.
Conley Frog & Switch Co., Memphis, Tenn.
Continuous Rail & Safety Switch Co., St. Louis, Mo.
Detroit Steel Products Co., Detroit, Mich.
Engineering News, New York.
Heath & Milligan Manufacturing Co., Chicago.
C. W. Hunt Company, West New Brighton, N. Y.
Iowa Gate Company, Cedar Falls, Iowa.
O. N. Kelly, Salt Lake City, Utah.
Nachod Signal Co., Philadelphia, Pa.
National Roofing Co., Tonawanda, N. Y.
Standard Scale & Supply Co., Pittsburgh, Pa.
Sterling Varnish Co., Pittsburgh, Pa.
Strauss Bascule Bridge Co., Chicago.
Waughn Rail Support Co., St. Louis, Mo.
Weir & Craig Manufacturing Co., Chicago.
Western Electric Company, Chicago.
Whyte Railway Signal Co., Toronto, Ont.

Canadian Railway Club.

The ninth annual dinner of the Canadian Railway Club was held at the Windsor Hotel, Montreal, Que., Friday evening, January 27, with an attendance of about 150. The toast "The Railways" was responded to by D. Crombie, assistant to the vice-president of the Grand Trunk, who replied to various criticisms of the railways. In Montreal, however, the relations between the railways and the public are amicable, the press being in touch with the railway managements. Other speakers were C. J. Phillips, H. H. Vaughan, Dean Adams, of the McGill University; E. M. Tewkesbury, and G. Pearsall. From the business men present the expressions concerning the business outlook for the present year were decidedly hopeful.

Air Brake Association.

The eighteenth annual convention of the Air Brake Association will be held at the Auditorium Hotel, Chicago, May 23 to 26, 1911. W. S. Bartholomew, 1545 Railway Exchange building, Chicago, is general chairman of the committee on arrangements. The following subjects will be discussed: Air Brake Instruction, Rating; Brake Cylinders and Connections; Adequate Braking Power for Freight Cars; Cost of Maintenance of Locomotive Brakes; Running Triple Valves Without Lubricant; Fibre Stresses in Brake Gear Parts; PC Equipment, lecture illustrated by stereopticon views; Steel Pipe *versus* Iron Pipe Recommended Practice; Topical Subjects; Friction of New and Worn Brake Shoes on New and Worn Cast Wheels; Breaking-in-two of Trains.

The Canadian Society of Civil Engineers.

At the meeting of the general section of the Canadian Society of Civil Engineers, held on February 2, at Montreal, Que., a paper on Aesthetics in Bridge Design, was read by the author, Prof. C. R. Young, A.M. Can. Soc. C.E., of the University of Toronto.

American Society of Mechanical Engineers.

At the next meeting of the American Society of Mechanical Engineers, to be held February 14, in New York, John Calder, manager of the Remington Typewriter Works, Ilion, N. Y., will present a paper on The Prevention of Industrial Accidents.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; annual convention, May 23-26, Chicago.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911; Niagara Falls, N. Y.

AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., 1911.

AMERICAN ASSOCIATION OF LOCAL FREIGHT AGENTS.—G. W. Dennison, Pennsylvania Co., Toledo, Ohio.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.—H. C. Donecker, 29 W. 39th St., New York.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York; May 17, New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago; Oct. 17-19, 1911; St. Louis, Mo.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—E. H. Fritch, Monadnock building, Chicago; March 21-23, 1911, Chicago.

AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.; May 9, 1911; Detroit, Mich.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—O. T. Harroun, Bloomington, Ill.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wednesdays, except June and August; New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—D. J. Haner, 13 Park Row, New York; 3d Tuesday of each month, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 29th St., New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 26, 1911; New Orleans, La.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—J. R. McSherry, C. & E. I., Chicago; May, 1911; Montreal, Can.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago; semi-annual, June, Washington, D. C.; annual, November, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911; Boston, Mass.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Place, New York; June 20-21, 1911, Cape May City, N. J.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug.; Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays; Montreal.

CAR FOREMAN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month; annual, October 9, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug.; St. Paul.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Richmond, Va.; June 21, St. Paul, Minn.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—H. D. Judson, 209 East Adams St., Chicago; Wednesday preceding 3d Thursday; Chicago; annual, July 29, Chicago.

INDIANAPOLIS RAILWAY AND MECHANICAL CLUB.—B. S. Downey, C., H. & D., Indianapolis, Ind.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York; next convention, Omaha, Neb.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; May 15-18, 1911; Chattanooga, Tenn.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn. Next convention July 25-27, Chicago.

INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.

INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION, OF UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.; Sept. 12-15, 1911, Atlantic City, N. J.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept.; Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.

NORTHERN RAILWAY CLUB.—C. L. Kennedy, C., M. & St. P.; 4th Saturday; Richmond, Va.; 20th annual, June 21, 1911, St. Paul, Minn.

OMAHA RAILWAY CLUB.—A. H. Christiansen, Barker Blk.; second Wed.

RAILWAY CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo., 3d Friday in Month; Kansas City.

RAILWAY CLUB OF PITTSBURGH.—C. W. Alleman, P. & L. E., Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa.; March 20, Chicago; annual, Oct. 10, Colorado Springs, Colo.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; annual, May 22-24, 1911; Milwaukee, Wis.

RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Oct., 1911; St. Louis.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis; annual, Oct. 20. Atlanta.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago; Sept. 12-14, St. Paul, Minn.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.; semi-annual, April 20, Atlanta, Ga.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Prudential bldg., Atlanta, Ga.; 3d Thurs.; Jan., April, August and Nov.; Atlanta.

TOLEDO TRANSPORTATION CLUB.—L. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday; annual, May 6, 1911; Toledo.

TRAFFIC CLUB OF CHICAGO.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August; New York.

TRAFFIC CLUB OF PITTSBURGH.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly; Pittsburgh.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911; Baltimore, Md.

TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; 1st Sat. after 1st Wed.; annual, Dec. 11, 1911.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; annual, August, 1911, Chicago.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August; annual, May 8, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August; Chicago.

WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, First National Bank bldg., Chicago.

Traffic News.

The managers of the New York Produce Exchange have taken action looking to the establishment of a freight bureau, at the head of which will be a traffic expert.

The Railroad Commission of Nevada has complained to the Interstate Commerce Commission that the railways of that state refuse to obey a finding of the state commission, handed down last August, reducing freight rates.

The Cartens Packing Company, of Tacoma and Seattle, has complained to the Interstate Commerce Commission, asking for a reduction of 50 per cent. in the rates on live cattle from points in Colorado, Wyoming, Montana, Utah, Idaho and Oregon. The present rates are alleged to give unreasonable advantage to shippers in Chicago, Kansas City and Omaha.

The Indiana Manufacturers' & Shippers' Association has complained to the Indiana railway commission about the increases in coal rates which became effective on December 1 and December 19. Its petition names several towns and cities which, it is alleged, are injured, and sets out that the old rate of 60 cents a ton to points in the gas belt was satisfactory, but alleges that the new rate of 65 cents is unjust.

The Land and Industrial Department of the Southern Railway reports increased production of alfalfa in widely separated districts. In Washington county, Mississippi, a field of 28 acres seeded in the fall of 1909 produced 168.8 tons at a cost of $593. Estimating this hay to be worth $15 a ton in the barn, the profit was $1,940 on the 28 acres, the hay costing only $3.47 per ton. Reports from the Delta show that about 50 farmers are now growing alfalfa with success. At Newport in east Tennessee, five tons an acre has been reported, and the price is $22 a ton.

F. C. Donald, commissioner of the Central Traffic Association, has denied in an interview that the roads belonging to this association have refused to sell tickets to Europe by the vessels of independent steamship companies. Mr. Donald says that it has been the practice for years for railways to pay a 10 per cent. commission to steamship companies which sell railway tickets to immigrants. The agents always are instructed to see that passengers exercise their own judgment in selecting the railway over which to travel. All that the railways have done is to refuse to deal with any except responsible persons.

The Pullman Company put into effect general reductions in sleeping car rates on February 1. The reductions, as previously announced in this paper, range from 25 cents to $1 on lower berths for a considerable proportion of all the long-distance runs, and make the rates for upper berths 20 per cent. lower than for lower berths, on all routes. Some of the rates for lower berths are $1.75, $2.25, etc., instead of being all in even half-dollars as heretofore. Rates for upper berths in tourist cars are reduced 20 per cent. as compared with lowers, which are not changed; minimum upper berth rate $1.

The railway commissions of Michigan, Indiana and Ohio have joined in a petition to the Interstate Commerce Commission asking that the roads in the official classification territory be required to add one or more classes to the six now in use in the classification of freight, and that said classes be so proportioned and arranged that the rates applicable on commodities named in the lowest class shall not exceed 10 per cent. of the first class. The petition says that by reason of the great variance in the weight, bulk and value of the commodities the six classes now in use are inadequate and insufficient, and that many cheap and heavy commodities are entitled to be carried at a less charge than the sixth class rates.

Officers of the Union Pacific and the Atchison, Topeka & Santa Fe talked on railway rates to a meeting of about 300 business men of Denver in that city on January 25. Among the speakers were J. A. Munroe, freight traffic manager of the Union Pacific; E. L. Copeland, secretary and treasurer of the Santa Fe, and J. R. Koontz, general freight agent of the Santa Fe. W. W. Hall, president of the Denver branch of the American Railway Employees' & Investors' Association, also spoke. Mr. Munroe and Mr. Koontz were subjected to a fire of questions, some of them being from George J. Kindel, the well known Denver rate champion. According to the reports in the Denver newspapers, Mr. Kindel met his match and more when he tackled these two experienced traffic officers.

The Maine Steamship Company has filed a certificate of increase in capital stock from $350,000 to $2,150,000, and announces that the company will acquire the steamers Bunker Hill, Massachusetts and Old Colony, which boats will take the place of the Harvard and Yale on the run between New York and Boston. The Maine Steamship Company is controlled by the New York, New Haven & Hartford. The three boats are being overhauled so as to carry passengers, and will be ready for service June 1. The outside line between New York and Boston will be operated under the name of the Maine Steamship Co.—Metropolitan Line. The New York and Portland run will be operated by the Maine Steampship Co.—Portland Line. The Metropolitan Steamship Company will lose its identity as a passenger line as its operations in the future will be confined to carrying freight.

New York and Montreal Wheat Exports.

Hon. Charles A. Prouty, Interstate Commerce Commissioner, took testimony in New York City this week on the complaint of the New York Produce Exchange concerning freight rates on grain from Lake Erie to New York City. The grain men declare that the export trade of New York has been largely diverted to Montreal, and it is charged that the tariffs of the railways to New York discriminate against grain coming from Minnesota and other western states by lake, in favor of grain coming from Canada. In the summer of 1903 the rate on wheat from Buffalo was raised from 4 cents a bushel to 5 cents, and since that time Montreal has been getting the lion's share. Last year the rate from Buffalo on wheat for domestic points was 6.5 cents a bushel, and for export, 5.5 cents; while on Canadian grain, brought through in bond, for export, it was 4 cents. In spite of this, Montreal got 75 per cent. of all the wheat exported from the United States to transatlantic ports. The following figures were presented:

WHEAT EXPORTS DURING SEASON OF NAVIGATION 1906-1910.
(United States and Canadian Government Figures.)

	(Bushels) Exported from New York		
Year.	Produced in U. S.	Produced in Canada.	Total.
1906	10,454,682	2,237,019	12,691,701
1907	15,252,783	2,622,917	17,875,700
1908	13,902,028	2,309,890	16,211,918
1909	7,411,214	1,836,699	9,247,913
1910	1,303,696	4,732,725	6,036,421

	(Bushels) Exported from Montreal				Aver. rate per bu.,
Year.	Produced in U. S.	*Per cent.	Produced in Canada.	Total.	Buffalo to N. Y.
1906	949,155	8.3	12,893,431	13,842,586	4.58
1907	4,774,267	23.8	13,347,742	18,122,009	5.5
1908	10,908,195	43.9	19,553,152	30,461,347	5.5
1909	10,731,498	59.1	14,300,137	25,031,635	5.1
1910	3,882,885	74.9	16,537,149	20,420,034	5.5

*Percentage via Montreal of the total of United States wheat exported from the two ports.

It was said that vessels from New York now ballast with water, where formerly they carried grain.

A representative of the International Mercantile Marine Company said that in 1909 the steamers of his company did not carry any grain to Europe; and lately, because of the falling off in the exports of wheat and cattle, two steamers had been withdrawn from the New York service, while several had been added to the Montreal line. The Hamburg-American line also showed that the amount of grain carried by it to Hamburg in 1910 was only 60 per cent. of the amount carried in 1909.

Traffic Club of Chicago.

The annual dinner of the Traffic Club of Chicago took place at the La Salle Hotel on Wednesday evening, January 26. Judge Peter S. Grosscup, of the United States Circuit Court, an honorary member of the club, was toastmaster, and speeches were made by J. Adam Bede, formerly a congressman from Minnesota, and Charles F. Moore, of New York. Neither of the speeches dealt very specifically with railway matters, being of a facetious nature. Judge Grosscup commented, in introducing one of the speakers, on the inconsistency between the Interstate Commerce act and the Sherman act. He said that on one page of the

statute books the Interstate Commerce act says that railways must not discriminate, but that when the railway man turns over a leaf to the next page he finds a provision which says that for railways to agree to prevent discrimination is criminal conspiracy. The dinner was attended by about 500 persons.

Car Surpluses and Shortages.

Arthur Hale, chairman of the committee on relations between railways, in presenting statistical bulletin No. 87A, giving a summary of car shortages and surpluses by groups from September 29, 1909, to January 18, 1911, says:

"The surplus totals 122,297 cars, an increase during the two weeks of 11,865 cars.

"The increase in surplus coal cars is 11,310, while the box car surplus decreased 832 cars, the latter due chiefly to the increased demand for this class in groups 6 (Northwestern), 10 (Pacific), and 11 (Canadian). In the latter group, a surplus of 4,771 cars reported two weeks ago has been almost entirely wiped out.

"The shortage shows a slight reduction, although there are some increases in the box car shortage in Groups 6 (Northwestern) and 11 (Canadian)."

The accompanying table gives surpluses and shortages by groups for the last period covered by the report, the charts show total surpluses and shortages in 1907, 1908, 1909, 1910 and 1911.

INTERSTATE COMMERCE COMMISSION.

One of the Western lines recently wrote to the Interstate Commerce Commission that it desired to insert a clause in its tariffs providing that "employees of private cars (owned or chartered by the parties using them) namely, cooks and porters in service (not private service), will be regarded as train employees and carried free." The commission replied that the provision proposed is not considered by the commission to be legal; that the servants which the act permits to be carried free are only such as are fairly to be included in the word "family," and that other private servants cannot be brought within the provisions of the act by being regarded as train employees when such is not in fact the case.

Reparation Awarded.

Barrett Mfg. Co. v. C., M. & St. P. Opinion by Chairman Clements.

Rate of 70 cents minimum carload 30,000 lbs., on mixed carload shipments of building and roofing paper, saturated felt, etc., found unreasonable to the extent it exceeded 63 cents, minimum weight 40,000 lbs. Reparation awarded. (20 I. C. C., 79.)

Ephrata Not Discriminated Against.

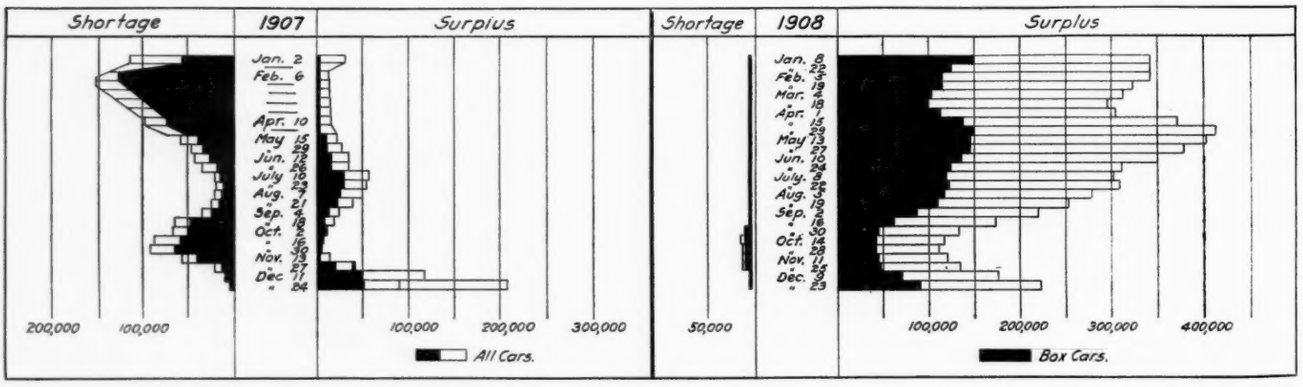
American Cigar Co. v. P. & R.

Existence of commodity rate of 21 cents on tobacco in carloads,

CAR SURPLUSES AND SHORTAGES.

Date.	No. of roads.	Surpluses: Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Shortages: Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
Group *1.—January 18, 1911	8	379	1,539	1,770	165	3,853	2	0	0	90	92
" 2.— " 18, 1911	22	7,422	666	8,960	6,544	23,592	0	0	25	14	39
" 3.— " 18, 1911	24	6,465	1,270	21,089	3,469	32,293	0	125	0	368	493
" 4.— " 18, 1911	10	3,110	286	672	1,413	5,481	0	50	328	0	378
" 5.— " 18, 1911	17	1,986	549	1,423	656	4,614	0	75	0	0	75
" 6.— " 18, 1911	21	6,634	1,345	4,508	4,738	17,225	395	6	10	150	561
" 7.— " 18, 1911	3	208	274	1,083	539	2,104	45	0	0	2	47
" 8.— " 18, 1911	15	4,056	358	3,229	2,538	10,181	4	0	0	2	6
" 9.— " 18, 1911	11	3,417	357	543	858	5,175	0	0	0	0	0
" 10.— " 18, 1911	19	4,821	2,466	2,494	7,486	17,267	5	0	0	43	48
" 11.— " 18, 1911	4	31	252	22	207	512	264	253	0	221	738
Total	154	38,529	9,362	45,793	28,613	122,297	715	509	363	890	2,477

*Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland, and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia, and Florida lines; Group 6—Iowa, Illinois, Wisconsin, Minnesota and the Dakotas lines; Group 7—Montana, Wyoming and Nebraska lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Oregon, Idaho, California and Arizona lines; Group 11—Canadian lines.



Car Surpluses and Shortages.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF NOVEMBER, 1910. (SEE ALSO ISSUES JANUARY 13, 20 AND 27.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$103,180	$44,814	$159,036	$22,011	$31,028	$3,200	$53,313	$4,308	$113,860	$45,176	—$346	$5,290	$39,540	—$20,059
Ann Arbor	301	128,747	38,341	178,585	23,843	19,076	3,471	56,202	6,570	109,162	69,423	1,395	14,265	56,553	16,752
Arizona Eastern	347*	88,758	33,534	131,475	24,057	12,662	1,877	40,159	3,273	82,028	49,447	.....	6,944	42,503	—36,624
Atlantic City	166	66,076	42,347	113,857	25,795	15,061	1,915	68,688	785	112,245	1,612	—3,120	7,000	—8,507	9,050
Carolina, Clinchfield & Ohio	237	136,588	10,604	150,453	15,394	19,510	5,424	32,548	7,472	80,348	70,105	.....	5,500	64,605	38,958
Carolina, Clinchfield & Ohio of S. C.	18	7,058	1,613	8,898	460	36	923	2,451	410	4,280	4,618	.....	200	4,418	—
Charleston & Western Carolina	340	139,892	34,802	182,071	30,654	23,332	3,301	56,959	4,131	118,377	63,694	.....	4,475	59,219	14,936
Chesapeake & Ohio of Indiana	284	105,205	20,619	132,326	35,988	23,839	5,895	72,378	4,875	142,976	—10,650	.....	3,790	—14,440	—
Chicago & North Western	7,734†	4,603,075	1,528,911	6,728,749	826,689	778,002	94,104	2,746,665	132,454	4,577,914	2,150,835	—8,267	287,000	1,855,568	30,163
Chicago, Peoria & St. Louis	255	126,656	23,834	159,192	21,121	33,090	7,212	78,078	5,955	145,456	13,736	.....	4,500	9,236	—26,513
Cincinnati Northern	248	93,061	14,600	112,921	14,270	17,130	3,960	43,913	2,837	82,110	30,811	.....	4,500	26,311	12,151
Cleveland, Akron & Columbus	212	182,252	44,954	241,703	43,584	35,470	2,693	78,685	3,384	163,816	77,887	.....	13,000	64,887	6,900
Colorado Midland	338	151,245	24,324	195,472	23,991	42,943	5,501	84,621	5,674	162,130	33,342	—777	8,500	24,065	—55,748
Detroit, Grand Haven & Milwaukee	190	109,456	38,470	173,320	18,666	24,157	5,460	80,781	3,928	132,992	40,328	—39	3,009	37,280	—22,176
Detroit, Toledo & Ironton	441	137,547	13,045	164,315	33,540	25,898	2,637	89,030	5,673	156,778	7,537	—1	6,712	824	—1,274
Hocking Valley	350	562,513	69,254	675,078	117,737	98,920	8,982	211,206	13,554	449,499	225,579	.....	29,725	195,854	—62,968
International & Great Northern	1,159	633,527	194,426	878,036	115,305	125,280	20,405	333,130	21,597	615,717	262,319	—99	22,000	240,220	26,858
Iowa Central	559	255,956	41,801	311,694	35,983	48,834	6,305	128,371	8,711	228,204	83,490	.....	9,794	73,696	—12,330
Kanawha & Michigan	175	228,543	27,069	261,078	27,833	52,173	2,047	74,809	6,927	163,789	97,289	—31	7,800	89,458	10,170
Kansas City, Mexico & Orient	740	139,548	37,348	186,812	36,477	33,079	8,478	76,817	7,481	162,352	24,480	.....	2,705	21,775	—4,720
Lehigh Valley	1,432	2,829,133	324,399	3,271,262	317,324	529,031	76,631	1,066,182	60,348	2,049,516	1,221,746	—7,419	94,600	1,119,727	—252,698
Louisiana Ry. & Nav. Co.	350	130,832	21,376	166,442	29,904	18,061	5,838	67,214	6,850	127,867	38,575	.....	4,400	34,175	17,846
Louisiana Western	207	119,990	54,897	185,096	18,094	24,163	5,774	55,328	7,803	111,162	73,934	159	6,077	68,016	—4,303
Minneapolis & St. Louis	1,027	322,676	89,281	439,635	56,222	54,961	8,230	185,691	13,605	318,709	120,926	—79	21,428	99,419	—59,823
Missouri, Kansas & Texas	1,737	1,198,493	418,577	1,707,224	197,516	233,835	35,522	522,682	41,427	1,030,982	676,242	—1,357	34,500	640,385	—
Missouri, Kansas & Texas of Texas	1,348	755,342	339,207	1,154,549	131,859	66,073	21,825	491,970	38,040	749,767	404,782	2,183	22,500	384,465	202,784
Missouri Pacific	3,920‡	1,514,905	364,811	2,098,464	367,809	370,071	56,808	990,409	67,951	1,853,049	245,415	—3,045	83,500	158,870	—316,469
Morgan's La. & Texas R. R. & S. S. Co.	348	455,263	90,431	582,401	52,508	49,422	10,200	177,823	13,810	303,763	278,638	—4,819	17,756	256,063	7,779
New Orleans & North Eastern	196	257,575	46,565	323,568	31,905	57,694	8,195	114,843	11,403	224,040	99,528	32	9,750	89,810	—7,422
Oregon & Washington	2448	82,679	69,366	157,560	13,030	6,560	12,758	65,960	3,680	101,988	55,572	—1,447	3,300	50,825	51,769
St. Louis, Iron Mtn. & Southern	3,316¶	1,963,322	482,324	2,642,675	349,831	345,151	58,401	805,664	74,213	1,633,260	1,009,415	—2,601	78,916	927,898	—41,595
Santa Fe, Prescott & Phoenix	364‖	107,568	39,828	155,271	22,698	14,758	2,453	46,358	5,915	92,182	63,089	.....	100	62,989	—2,251
Spokane, Portland & Seattle	433	200,205	76,483	307,726	38,030	17,949	4,277	104,347	9,831	174,434	133,292	—1,324	38,500	93,468	40,056
Tennessee Central	294	92,793	27,282	126,777	21,633	14,780	4,917	41,127	8,108	90,565	36,212	.....	3,980	32,232	—9,378
Toledo & Ohio Central	444	415,324	50,534	491,528	63,315	61,924	5,671	157,044	8,681	296,635	194,893	.....	18,548	176,345	14,453
Vicksburg, Shreveport & Pacific	171	80,457	45,109	137,660	19,688	20,939	3,255	38,545	4,314	86,741	50,919	—233	4,675	46,011	12,462
FIVE MONTHS OF FISCAL YEAR 1911.															
Alabama & Vicksburg	143	$482,803	$215,957	$753,210	$97,455	$123,661	$18,664	$251,269	$25,753	$516,802	$236,408	—$258	$22,850	$213,300	$14,702
Ann Arbor	301	543,898	241,805	839,656	117,852	96,169	20,096	275,204	32,525	541,846	297,810	12,388	71,326	238,872	19,017
Arizona Eastern	347*	474,765	164,200	688,261	125,466	63,013	9,554	194,743	21,048	413,824	274,437	.....	28,044	246,393	—36,128
Atlantic City	166	338,746	712,481	1,099,611	125,955	56,870	17,543	476,112	7,442	683,922	415,689	—27,101	35,000	353,588	64,437
Carolina, Clinchfield & Ohio	237	541,378	77,634	640,479	62,167	91,617	26,735	136,915	39,919	357,353	283,126	.....	27,500	255,626	132,500
Carolina, Clinchfield & Ohio of S. C.	18	27,800	7,335	36,600	2,920	259	4,570	11,282	2,578	21,609	14,991	.....	1,000	13,991	—
Charleston & Western Carolina	340	547,128	160,716	744,469	142,468	103,576	16,388	243,862	19,268	525,562	215,907	.....	22,375	193,532	46,228
Chesapeake & Ohio of Indiana	284	507,354	148,103	690,012	159,815	109,403	32,851	326,694	23,510	652,273	37,739	.....	18,950	18,789	—
Chicago & North Western	7,735†	22,568,294	9,027,396	34,479,078	5,261,063	3,871,425	552,101	13,203,887	668,969	23,557,445	10,921,633	2,379	1,335,000	9,589,012	—842,865
Chicago, Peoria & St. Louis	255	610,010	153,132	801,174	122,801	154,415	35,601	338,608	28,268	679,693	121,481	.....	22,500	98,981	—62,502
Cincinnati Northern	248	456,273	112,652	597,368	89,702	121,120	17,874	215,030	14,980	458,706	138,662	.....	22,500	116,162	—28,471
Cleveland, Akron & Columbus	212	874,535	271,456	1,217,791	236,701	182,998	15,641	384,129	18,851	838,320	379,471	.....	42,000	337,431	57,613
Colorado Midland	338	680,739	170,441	953,634	127,685	193,592	27,509	387,107	28,141	764,034	189,600	—1,217	42,500	145,883	—94,947
Detroit, Grand Haven & Milwaukee	190	461,492	277,158	858,135	138,515	100,919	30,830	392,386	21,278	683,928	174,207	—59	15,045	159,103	—82,798
Detroit, Toledo & Ironton	441	752,116	81,306	899,834	158,585	157,838	14,631	433,586	27,724	792,364	107,470	—74	33,560	73,836	—2,141
Hocking Valley	350	2,961,017	414,783	3,621,048	451,513	505,319	45,316	1,054,855	76,645	2,133,648	1,487,400	.....	149,685	1,337,715	—1,282
International & Great Northern	1,159	3,016,033	928,659	4,197,873	600,471	576,499	96,107	1,537,338	106,369	2,916,784	1,281,089	—1,288	108,000	1,171,801	389,442
Iowa Central	559	1,173,307	261,053	1,500,181	190,864	270,202	36,273	587,509	44,940	1,129,788	370,393	.....	48,927	321,466	—51,916
Kanawha & Michigan	175	1,253,072	161,386	1,443,086	159,042	248,365	12,353	375,392	31,994	827,146	615,940	—70	40,036	575,834	198,152
Kansas City, Mexico & Orient	740	598,863	208,218	841,584	161,794	170,821	37,945	375,834	38,930	785,324	56,260	.....	22,572	33,688	—72,797
Lehigh Valley	1,432	12,922,320	2,206,157	15,680,343	1,674,213	2,563,671	434,876	4,871,333	314,148	9,858,241	5,822,102	—119,395	465,800	5,236,907	—563,995
Louisiana Ry. & Nav. Co.	350	541,444	102,736	712,971	132,395	85,462	24,690	286,095	30,219	558,861	154,110	.....	22,000	132,110	41,791
Louisiana Western	207	552,775	261,348	854,088	81,612	127,356	30,452	247,053	36,386	522,858	331,230	1,443	30,385	302,288	—35,205
Minneapolis & St. Louis	1,027	1,618,094	600,900	2,365,077	271,190	284,181	56,609	878,599	69,537	1,560,116	804,961	—195	102,718	702,048	—115,300
Missouri, Kansas & Texas	1,737	5,132,092	2,094,440	7,690,120	1,092,506	1,127,463	181,080	2,475,810	220,550	5,097,410	2,592,710	—55	274,626	2,318,029	—
Missouri, Kansas & Texas of Texas	1,348	3,156,535	1,662,301	5,095,853	774,949	311,378	115,854	2,120,811	170,136	3,493,128	1,602,725	—2,733	112,500	1,487,492	243,600
Missouri Pacific	3,920‡	8,070,423	2,205,900	11,387,477	1,835,613	1,809,542	308,631	4,768,769	351,369	9,073,924	2,313,553	—11,423	417,500	1,884,630	—
Morgan's La. & Texas R. R. & S. S. Co.	348	1,486,140	480,233	2,084,567	288,133	252,633	54,321	721,468	66,583	1,383,138	701,429	—12,294	88,780	600,355	—11,855
New Orleans & North Eastern	196	1,113,704	260,019	1,463,204	144,528	224,317	46,059	511,160	53,821	979,885	483,319	—219	42,750	440,350	18,820
Oregon & Washington	2448	405,178	381,967	821,416	66,635	26,245	50,992	331,123	19,714	494,709	326,707	—5,588	16,500	304,619	305,869
St. Louis, Iron Mtn. & Southern	3,316¶	8,354,739	2,556,508	11,848,025	1,870,884	1,673,942	285,497	4,078,834	378,174	8,287,331	3,560,694	—13,190	392,580	3,154,924	—536,918
Santa Fe, Prescott & Phoenix	364‖	471,777	183,020	700,536	124,003	64,623	13,273	221,997	27,352	451,248	249,288	.....	501	248,787	—21,960
Spokane, Portland & Seattle	433	1,566,635	444,541	2,118,617	230,356	134,530	19,337	551,785	47,861	983,869	1,134,748	—2,723	159,100	972,925	493,833
Tennessee Central	294	429,496	178,334	645,182	92,005	59,409	24,936	188,082	39,954	404,386	240,796	.....	19,900	220,896	9,393
Toledo & Ohio Central	444	2,025,458	315,025	2,477,408	316,896	309,024	33,488	742,281	40,916	1,442,605	1,034,803	.....	81,263	953,540	243,363
Vicksburg, Shreveport & Pacific	171	389,536	209,970	646,328	89,075	110,041	17,543	190,624	22,188	429,472	216,856	—77	30,175	186,604	36,177

Mileage operated on November 30, 1909.—* 308 miles; † 7,638 miles; 660 miles; ‡ 3,881 miles; § 6 miles; ¶ 2,610 miles; ‖ 257 miles; — indicates Deficits, Losses and Decreases.

Lancaster, Pa., to Richmond, Va., did not result in undue discrimination against Ephrata, Pa., from which point class rate of 24 cents was in force. Overcharge found, and to be refunded without order. (20 I. C. C., 81.)

Ties Must Be Carried As Cheaply As Lumber.

Fullerton Powell Hardwood Lumber Company v. Virginia & Southwestern.

Rate charged on a carload shipment of cross-ties from Harvey, Va., to Muskegon, Mich., found to be unjust and unreasonable in so far as it exceeded the rate contemporaneously in effect between said points on lumber. (20 I. C. C., 86.)

"Midnight Tariffs."

Du Pont, etc., v. Depue & Northern.

Certain commodity rates, subsequent to the shipments herein involved, were made effective by defendant for one month only. Such reduced rates were effective via competing lines at time of shipments, but for limited time only. No proof presented as to reasonableness of rate. Reparation denied and complaint dismissed. (20 I. C. C., 83.)

Refusal to Establish Through Route.

Iola Portland Cement Company v. M. K. & T.

Although complainant knew of an existing through route and joint rate over the Atchison, Topeka & Santa Fe and Fort Worth & Rio Grande, it nevertheless routed shipments over the Missouri, Kansas & Texas and the Fort Worth & Rio Grande, the applicable published rates being a higher combination of intermediate rates; *Held,* That complainant is not entitled to reparation and that prayer for establishment of through route and joint rate over the Missouri, Kansas & Texas and Fort Worth & Rio Grande, upon supposition that such action is a necessary corollary to an award of reparation, should be denied. (20 I. C. C. 91.)

Fourth Section Not Violated.

Nebraska Material Company v. C. B. & Q.

Rate of 12 cents on common brick from Mound Valley, Kan., to Tecumseh, Neb., not found to have been unreasonable or unjustly discriminatory as compared with the rate of 8 cents to Lincoln, Neb., a point 48 miles more distant and on the same line. Tecumseh is a local station on the Chicago, Burlington & Quincy, about 48 miles southeast of Lincoln. The shipments moved over the St. Louis & San Francisco to Kansas City, thence to destination over the Burlington. Traffic carried from Mound Valley to Lincoln over this route passes through Tecumseh. The 8-cent rate to Lincoln was cancelled by defendants on January 4, leaving in force to those points a through rate of 11 cents made up of the combination of intermediate rates. The 12-cent rate to Tecumseh was legally effective at the date of these shipments, and is still in force. Defendants assert that the rate to Tecumseh is reasonable, and that the maintenance of a rate to Tecumseh higher than the rate to Lincoln and the other points mentioned was not prohibited by the fourth section of the act as it existed prior to June 18, 1910, because competitive conditions rendered transportation to the latter points substantially dissimilar from carriage to Tecumseh.

It appears that the Missouri Pacific Railway Company has lines reaching from points in the so-called Kansas gas belt, in the vicinity of Mound City, to Lincoln, which do not pass through Tecumseh. On January 1, 1907, that company reduced to 8 cents its rate on brick from the Kansas gas belt points to Lincoln. To obtain a share of the traffic the defendants made the same rates as the Missouri Pacific to competitive points such as Lincoln and Omaha, but they did not apply those rates to intermediate points on their lines. Nebraska City and Plattsmouth were given Omaha rates because they are junction points of the Burlington and the Missouri Pacific. Defendants say that they cancelled the 8-cent rate because it was unreasonably low for the service rendered and was considered unremunerative. Our conclusion is that th competitive conditions existing in respect of the transportation to Lincoln, Omaha, Plattsmouth, and Nebraska City were such that the maintenance of a higher rate to Tecumseh was not a violation of the fourth section of the act as interpreted by the courts previous to its recent amendment. Complaint dismissed. It must be understood that our decision in this case is without prejudice to any investigation which may be made under the present requirements of the fouth section. (20 I. C. C. 89.)

Action on Long and Short Haul Law Postponed.

An order has been issued by the commission to the effect that the long-and-short-haul clause of the revised law will not become effective until the commission has had an opportunity to pass on the merits of applications made by the carriers for relief. The order provides that the carrier may file with the commission such changes in their rates as may be necessary in the ordinary course of their business, "continuing under the present basis or adjustment higher rates or fares at intermediate points and through rates or fares higher than the combinations of intermediate rates or fares, provided that in so doing, the discrimination against intermediate points is not made greater than that in existence on August 17, 1910, except when a longer line or route reduces rates or fares to the more distant point for the purpose of meeting by a direct haul a reduction that has been made by the short line." Such rates and fares are subject to correction if they conflict with any of the provisions of the act.

STATE COMMISSIONS.

The Corporation Commission of Virginia held hearings last week on the petition of the Richmond, Fredericksburg & Potomac for authority to raise passenger fares from 2 cents a mile to 3 cents.

The New York State Public Service Commission, Second District, has received notice from the New York Central in the nature of a demurrer as to the complaint of Hon. Thomas M. Osborne as to the charge for taking care of parcels at parcel rooms in the passenger stations of the company. The company raises the question that the charge for the checking of parcels is not made for the transportation of passengers or property or for any service rendered in connection therewith; that the service is not within the duties owed by the defendant to the public, and is not within its profession as a common carrier. The service is voluntary, and is available to any person without respect to his having been or his intention to become a passenger. A hearing is demanded on the question of the jurisdiction of the commission.

FOREIGN RAILWAY NOTES.

It is proposed to construct a railway connecting the Nigerian tin fields in the province of Bauchi, Nigeria, Africa, with the Baro-Kano line.

The Buenos Aires Great Southern, with 3,038 miles of line, is now the largest Argentine railway, exceeding the Buenos Aires and Pacific with its 3,028 miles.

The Buenos Aires Western Railroad Company, Argentina, has been authorized to construct and operate a branch line, 49 miles long, to connect the La Zanja station with that of Meridiano V.

Messrs. Gibbs & Co. have secured from the Chilean government a concession for the construction and operation, during 50 years, of a railway from Caleta de Chucumata to Oficina Alianza, a distance of nearly 55 miles.

The department of public works of Brazil has signed a contract with Messrs. J. de Oliveira Fernandes and Humberto Saboya de Albuquerque for the construction of the section of the West of Minas Railway, between Henrique Galvao and kilometro 48 on the Goyaz Railway. By the terms of the contract the line must be completed within 18 months.

Work will shortly be commenced on the great engineering project of joining Ceylon with the mainland of Asia. The first step on the Indian side will be to build a viaduct about a mile long to carry the railway to the island of Rameswaram. The railway will be continued 22 miles across the island to the nearest point to Ceylon. From thence there will be a steam ferry to Ceylon. The remaining part of the route will be provided by an extension of the Ceylon railway system.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Osgood H. Dowell has been elected assistant counsel of the Eastern Railroad Association.

E. W. Winter, president of the Brooklyn Rapid Transit, has resigned. See editorial columns.

George W. Martin has been elected vice-president of the Pittsburgh & Susquehanna, with office at Philadelphia, Pa.

J. Welch has been appointed auditor of the Chicago, Milwaukee & Puget Sound and the Tacoma Eastern, with office at Chicago.

James I. Whallon has been appointed assistant auditor of the Lake Erie & Western, the Fort Wayne, Cincinnati & Louisville and the Northern Ohio, with office at Indianapolis, Ind., succeeding J. P. Hart, assigned to other duties.

J. F. Titus having resigned as assistant to the president of the Illinois Central, the Indianapolis Southern and the Yazoo & Mississippi Valley, W. L. Tarbet, tax commissioner of the Illinois Central, has been appointed land and tax commissioner of the three roads, with office at Chicago, reporting to the general attorney. The custody of deeds, records, contracts, title papers and other documents has been transferred from the tax commissioner to the assistant secretary, who will report to the comptroller. E. P. Skene, land commissioner of the Illinois Central, has been appointed assistant land and tax commissioner of the three roads, with office at Chicago.

Operating Officers.

W. J. Little has been appointed passenger trainmaster of the Northern division of the Grand Trunk, with office at Allandale, Ont.

Otto Holstein, chief despatcher of the Central Railway of Peru, at Lima, Peru, has been appointed also trainmaster, with office at Lima.

N. E. Bailey has been appointed superintendent of the United Verde & Pacific, with office at Jerome, Ariz., succeeding H. I. Russell, resigned.

T. W. Rowder has been appointed an assistant superintendent of the St. Joseph & Grand Island, with office at St. Joseph, Mo., succeeding C. E. Hedrix, appointed superintendent.

Henry W. Thornton, superintendent of the Erie & Ashtabula division of the Pennsylvania Lines West, at New Castle, Pa., has been appointed to the new position of assistant general superintendent of the Long Island Railroad, with office at Long Island City, N. Y.

H. S. Monehan has been appointed trainmaster of the First and Second districts, First division, of the Denver & Rio Grande, with office at Pueblo, Colo., succeeding R. T. McGraw, promoted, and J. Flynn has been appointed trainmaster of the Third and Fourth districts, First division, with office at Walsenburg, succeeding P. D. Sheehan, resigned.

E. H. Coapman, vice-president and general manager of the Southern Railway, at Washington, D. C., has been appointed also general manager of the Virginia & Southwestern. G. W. Taylor, general superintendent of transportation of the Southern Railway, at Washington, and G. R. Loyall, general superintendent at Knoxville, Tenn., have had their authority extended over the Virginia & Southwestern.

The reorganization of the Rock Island Lines into three districts is referred to editorially elsewhere in this issue. Incident to the reorganization, which was announced in the *Railway Age Gazette* of January 20, page 145, C. W. Jones, general superintendent of the Central district of the Chicago, Rock Island & Pacific at Davenport, Iowa, has been appointed general superintendent of the First district, with office at Davenport. J. B. Smalley, general superintendent of the Southwestern district at Topeka, Kan., has been appointed general superintendent of the Second district, with office at Topeka; and T. H. Beacom, general superintendent of the Southern district at El Reno, Okla., has been appointed general superintendent of the Third district, with office at El Reno. F. J. Easley, superintendent of the Missouri division at Trenton, Mo., has been appointed superintendent of the Illinois division, with office at Rock Island, Ill., succeeding H. P. Greenough. Mr. Greenough has been appointed superintendent of the El Paso division, with office at Dalhart, Texas, succeeding H. L. Reed, who succeeds Mr. Easley at Trenton, Mo. M. J. Kennelly, superintendent of the Louisiana division, has been appointed superintendent of the St. Louis division, with office at Eldon, Mo., succeeding G. Davis, who succeeds Mr. Kennelly on the St. Louis division. C. L. Ruppert, trainmaster on the Missouri division, has been appointed superintendent of the Amarillo division of the Chicago, Rock Island & Gulf, with office at Amarillo, Texas, succeeding H. E. Allen, resigned to accept service with another company.

Traffic Officers.

John L. Sullivan, traveling freight agent of the Chicago Great Western, at Fort Dodge, Iowa, has been transferred to Des Moines, Iowa.

W. D. Wright has been appointed district passenger agent of the New York Central Lines, with office at Williamsport, Pa., succeeding Frank Halloran, deceased.

W. W. Broughton, general traffic manager of the Great Northern, with office at St. Paul, Minn., has resigned to become vice-president of the Pittsburgh Coal Company, effective March 1.

Augustin Miranda has been appointed an assistant general freight and passenger agent of the Sonora Railway and the Southern Pacific of Mexico, with office in Mexico City, a new position.

R. J. Carmichael, district passenger agent of the Illinois Central at Chicago, has been appointed a division passenger agent, with office at Chicago, a new position, and his former office is abolished.

G. G. McKay, city ticket agent of the Canadian Pacific at Detroit, Mich., has been appointed a traveling passenger agent, with offices at St. Louis, Mo., succeeding Thomas J. Wall, appointed city passenger agent at Chicago.

J. P. Fresenius has been appointed a traveling freight agent of the St. Louis & San Francisco, the Chicago & Eastern Illinois, the Evansville & Terre Haute and the New Orleans, Texas & Mexico, with office at New Orleans, La.

S. D. Barlow has been appointed general freight agent of the Western Transit and the Rutland Transit Companies, with office at Buffalo, N. Y., and the positions of general westbound agent and special agent have been abolished.

H. G. Locke, traveling passenger agent of the Chicago Great Western at Boston, Mass., has been appointed a traveling passenger and freight agent, with office at Boston. J. H. Ranney also has been appointed a traveling passenger and freight agent, with office at Boston.

William E. Farris, assistant general freight and passenger agent of the Buffalo & Susquehanna Railroad and the Buffalo & Susquehanna Railway, at Du Bois, Pa., has been appointed general freight and passenger agent, with office at Buffalo, N. Y., and his former position has been abolished.

Warren P. Cameron, traveling freight solicitor in connection with the Sioux City, Iowa, agency of the Union Line Pennsylvania, has been appointed traveling freight solicitor in connection with the agency at St. Paul, Minn., succeeding F. C. Lang, transferred. Edward G. Pankau succeeds Mr. Cameron.

Ira E. Whyte, district passenger agent of the Central Railroad of New Jersey, at Asbury Park, N. J., has been appointed general baggage agent, with office at New York, succeeding F. B. Greenawalt, resigned. C. J. Gummersbach succeeds Mr. Whyte,

and G. D. Ginder has been appointed district passenger agent, with office at Scranton, Pa.

J. H. McCue, manager of the Virginia & Southwestern, has been appointed general agent of the Southern Railway and the Virginia & Southwestern, with office at Bristol, Tenn.-Va. He will have charge of all matters relating to traffic, and to the industrial and agricultural development of the territory traversed by the lines of the Virginia & Southwestern.

G. W. Benus, commercial agent of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern at Pittsburgh, Pa., has been appointed commercial agent, with office at Cincinnati, Ohio, succeeding J. B. Clancey, deceased. J. G. Hill, commercial agent at Indianapolis, Ind., succeeds Mr. Benus, and S. A. Williams, traveling freight agent at Birmingham, Ala., succeeds Mr. Hill.

Alexander Tinling, general agent of the Northern Pacific, at Seattle, Wash., has been appointed general freight agent, with office at St. Paul, Minn. N. H. Kennedy, general agent at Spokane, Wash., succeeds Mr. Tinling. J. O. Dalzell, assistant land commissioner, at St. Paul, Minn., succeeds Mr. Kennedy. E. A. McKenna, general agent, at Wallace, Idaho, has been appointed general agent, at Aberdeen, Wash., succeeding H. M. Williams, resigned. C. M. Grubbs succeeds Mr. McKenna.

A. E. Mann, traveling freight agent of the Louisville & Nashville in New York City, has been appointed a commercial agent, with office at Cleveland, Ohio. E. A. Fall, soliciting agent at Birmingham, Ala., succeeds Mr. Mann, and Maurice P. Davis succeeds Mr. Fall. W. C. Dillard, soliciting agent at Mobile, Ala., has been appointed a traveling freight agent, with office at Houston, Tex., and George C. Willings succeeds Mr. Dillard. C. F. Stith has been appointed a traveling freight agent, with office at Oklahoma City, Okla.

Incident to the re-districting of the Rock Island Lines, which was announced in the *Railway Age Gazette* of January 20, page 145, H. A. Snyder, general freight agent of the Chicago, Rock Island & Pacific, at Chicago, will have jurisdiction over the first district, with office at Chicago; F. J. Shubert, assistant general freight agent, at Kansas City, Mo., has been appointed general freight agent, with jurisdiction over the second district, with office at Kansas City, and H. W. Morrison, assistant freight traffic manager, at Little Rock, Ark., will have jurisdiction over the third district, with office at Little Rock.

H. C. McFadden, who has been appointed general freight agent of the Georgia & Florida, with office at Augusta, Ga., as previously announced in these columns, was born in 1867, at Mount Vernon, Ohio. He began railway work in 1885 as a clerk in the general freight and passenger department of the Cincinnati, Van Wert & Michigan, now a part of the Cincinnati Northern, at Van Wert, Ohio. In 1889 he was appointed a rate clerk in the passenger department of the Savannah, Florida & Western, now a part of the Atlantic Coast Line, at Savannah, Ga., and was promoted to chief clerk and then assistant general passenger agent. He left the service of that company in 1901. His next position was general freight and passenger agent of the Atlanta, Birmingham & Atlantic, from which he resigned in April, 1907, to become president and general manager of the Fitzgerald, Ocilla & Broxton, which position he now leaves to become general freight agent of the Georgia & Florida.

George M. Kridler, whose appointment as assistant general freight agent of the Lake Shore & Michigan Southern, with office at Cleveland, Ohio, has been announced in these columns, was born March 3, 1873, at Marlboro, Ohio. He received his education at Hudson, Ohio, and began railway work in December, 1890, with the Pennsylvania Company at Hudson, as a clerk in the local freight office. He was afterward transferred to Steubenville, Ohio, and later to Wellsville, Ohio, and in 1893 went to Cleveland, Ohio, where he was connected first with the Empire fast freight line, and then with the Red Line, until October, 1897. He was then made chief clerk to the commercial agent of the Lake Shore at Cleveland, and a year later was appointed contracting agent. In May, 1901, he was promoted to commercial agent, and he was transferred to Pittsburgh, Pa., as general agent in June, 1906. His next promotion was to division freight agent at Youngstown, Ohio, in September, 1910, which position he resigned January 1, 1911, to become assistant general freight agent at Cleveland.

Engineering and Rolling Stock Officers.

Willard Doud, shop engineer of the Chicago, Burlington & Quincy, at Lincoln, Neb., has resigned.

A. Stewart, general superintendent of motive power and equipment of the Southern Railway, and D. W. Lum, chief engineer maintenance of way, have had their authority extended over the Virginia & Southwestern, both with offices at Washington, D. C.

Frank W. Gilcreast, whose appointment as chief engineer of the Lehigh & New England, with office at Mauch Chunk, Pa., has been announced in these columns, was born April 2, 1858, at Woburn, Mass. He was educated at Tufts College, receiving the degree of C. E. in 1878, and began railway work in August, 1880, in the engineering department of the New York & New England, now a part of the New York, New Haven & Hartford. In January of the following year he went to the New York, Chicago & St. Louis, and the following June was appointed resident engineer. In September, 1882, he was appointed resident engineer of the Buffalo, Rochester & Pittsburgh, and the following year was made division engineer. He remained in this position until June, 1884, when the company went into the hands of a receiver. From May, 1885, to August, 1889, he was engineer for Brown, Howard & Co., on the New York Aqueduct. He returned to railway work in August, 1889, as resident engineer of the Schuylkill & Lehigh Valley, now a part of the Lehigh Valley, and in January, 1893, he was promoted to division engineer in charge of maintenance of way on the Mahanoy & Hazleton division, which position he held at the time of his recent appointment as chief engineer of the Lehigh & New England, in charge of the Tamaqua extension.

The reorganization of the Rock Island Lines into three districts is referred to editorially elsewhere in this issue. Incident to the reorganization, which was announced in the *Railway Age Gazette* of January 20, page 145, W. J. Tollerton, assistant general superintendent of motive power of the Chicago, Rock Island & Pacific at Chicago, has been appointed assistant general superintendent of motive power of all Rock Island Lines, with office in Chicago. F. W. Williams, superintendent of motive power of the Northern district at Cedar Rapids, Iowa, has been appointed master mechanic of the Cedar Rapids, the Minnesota and the Dakota divisions, with office at Cedar Rapids. T. W. McCarthy, master mechanic at Cedar Rapids, has been appointed master mechanic of the Kansas division, with office at Horton, Kan. H. J. Osborne has been appointed master mechanic of the Des Moines Valley division, with office at Valley Junction, Iowa. Frank W. Thompson has been appointed division engineer of the Iowa division, with office at Des Moines, Iowa. W. L. Hope has been appointed division engineer of the Illinois division, with office at Rock Island, Ill. Roy Johnson, district engineer at Cedar Rapids, has been appointed division engineer of the Missouri division, with office at Trenton, Mo. L. J. Hughes has been appointed division engineer of the El Paso division, with office at Dalhart, Tex. L. D. Harper has been appointed division engineer of the Kansas division, with office at Herington, Kan. H. M. Stone, district engineer at Topeka, Kan., has been appointed division engineer of the Arkansas division, with office at Little Rock, Ark. T. W. Fatherson has been appointed division engineer of the Indian Territory division, with office at El Reno, Okla. C. A. Richards has been appointed division engineer of the Oklahoma division, with office at Haileyville, Okla. J. M. McChord has been appointed a night roundhouse foreman at Rock Island, Ill., succeeding W. F. Negus. W. H. Peterson, principal assistant engineer at Chicago, has been appointed engineer maintenance of way of the First district, with office at Davenport, Iowa; J. M. Brown, district engineer at Davenport, has been appointed engineer maintenance of way of the Second district, with office at Topeka, Kan., and A. B. Warner, district engineer at El Reno, Okla., has been appointed engineer maintenance of way of the Third district, with office at El Reno. J. B. Kilpatrick, superintendent of motive power at Chicago, has been appointed superintendent of motive power of the First district, with office at Davenport, Iowa; S. W. Mullinix, superintendent of motive power at Horton, Kan., has been appointed superintendent of motive power of the Second district, with office at Topeka, and C. M. Taylor, superintendent of motive power at Shawnee, Okla., has been appointed superintendent of motive power of the Third district, with office at Shawnee.

OBITUARY.

M. L. Newton, consulting engineer of the Waterloo, Cedar Falls & Northern, with office at Waterloo, Iowa, died in that city on January 25.

J. B. Clancey, commercial agent of the Cincinnati, New Orleans & Texas Pacific, with office at Cincinnati, Ohio, died at Cincinnati on January 23.

James Fulton Elder, for many years superintendent of air brakes on the Pennsylvania Railroad, and the inventor of valuable improvements, died at his home in Philadelphia, Pa., January 30, at the age of 75 years. He entered the employ of the Pennsylvania Railroad at Altoona in 1856 and was a pioneer in air-brake development, having had charge of that work on the Pennsylvania throughout the years of the introduction of power brakes.

Col. Edward L. Russell, vice-president and general counsel of the Mobile & Ohio, died at the Raleigh Hotel, Washington, D. C., on January 28, from pneumonia. He was born in Franklin county, Alabama, in August, 1845, and entered the railway service in 1876 as general solicitor of the Mobile & Ohio. In March, 1897, he was elected first vice-president, and in February, 1898, he was made president, but in March, 1901, when the Southern Railway came into control, Samuel Spencer was elected president, Mr. Russell continuing at the head of the legal department as general counsel. Since October, 1904, he has also been vice-president.

James G. Taylor, formerly auditor and assistant treasurer of the Burlington & Missouri River, now part of the Chicago, Burlington & Quincy, at Omaha, Neb., died in New York City on January 23. Mr. Taylor was born in Albany county, New York, and was educated at Trinity Church school at Watervliet, N. Y. He began railway work in 1870 as a clerk with the Burlington & Missouri River, and was promoted consecutively to cashier, paymaster and assistant treasurer. He was also for a time assistant secretary of the Chicago, Burlington & Quincy. He left the Burlington in 1903, and has since made his home in New York City.

Erastus Clark, jr., formerly for many years general freight agent of the New York Central & Hudson River, died January 30 at the home of his son in New York City. He was born in Buffalo in 1826, and began railway work with the Buffalo & Rochester. He was freight agent in 1852, at the time the New York Central came into control and he was then appointed freight agent of the western division of the New York Central and several years later was made general freight agent of the entire system. Mr. Clark remained in that position until 1895, when he retired, but for several years thereafter he was retained by the company in an advisory capacity.

Joseph W. Reinhart, formerly president of the Atchison, Topeka & Sante Fe, and recently president of the Inter-City Viaduct and Terminal Company and the Inter-City Viaduct Freight Railway Company of Kansas City, Mo., died in Kansas City on January 27. Mr. Reinhart was born September 17, 1851, at Pittsburgh, Pa., and was educated at the Western University of Pennsylvania. He began railway work in 1869 as a clerk for the division superintendent of the Allegheny Valley, now part of the Pennsylvania Railroad, and for five years from 1875, he was superintendent of transportation of the same road. He was then made auditor of the Richmond & Allegheny, and three years later was appointed general auditor of the New York, West Shore & Buffalo. He became general auditor of the Atchison, Topeka & Sante Fe and auxiliary lines in 1888, and the following year was elected fourth vice-president and general auditor of that road; he also formulated and executed a plan for the financial reorganization of the Atchison Company, and was elected first vice-president and general auditor in 1890. From March, 1893, to September, 1894, he was president of the Atchison, Topeka & Sante Fe, the Gulf, Colorado & Sante Fe, the St. Louis & San Francisco, the St. Louis, Kansas City & Colorado, the Atlantic & Pacific, the Colorado Midland, the Wichita & Western, the Southern California, the New Mexico & Arizona, and the Sonora Railway, Ltd., and from December, 1893, to September, 1894, he was receiver also of these companies. From 1893 to 1894, he was chief expert of the United States Government under the Fifty-third Congress in reorganization of executive departments. On leaving the Sante Fe he became a special railway and corporation expert, and since 1909 has been interested in the railway projects in Kansas City mentioned above.

Railway Construction.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—According to press reports, this company is planning to rebuild the lines in eastern Texas between Port Bolivar, Texas, and Longview, to reduce the grades. This work is to be carried out in connection with the expected large tonnage of ore from Cass county, to which point the Port Bolivar Iron Ore Railway is now being built from Longview, about 30 miles. The terminal and port facilities at Port Bolivar are also to be enlarged. It is said that the company has under consideration the question of extending its lines east to New Orleans, La., as well as building an extension from Longview, Texas, north, to connect with its Oklahoma lines.

ATLANTIC, NORTHERN & SOUTHERN.—According to press reports, this line, which was built by residents of western Iowa, has completed work on the extension from Atlantic, Iowa, south to Villisca, 38 miles. (September 30, p. 598.)

BANGOR & AROOSTOOK.—This company has asked for an extension of time to March 1, 1918, in which to finish work on the Allegash extension from West Seboois, Me., north to St. Francis, 157 miles. The survey which has just been filed shows that the route from West Seboois is between Jo Mary and Twin lakes, south of Sourdnabunk lake, across the outlet of Chesuncook lake and east of Chamberlain lake, thence near the east bank of the Allegash river to St. Francis. It is understood that construction work will be started this year if the location is approved.

BLACK LICK & YELLOW CREEK.—A contract has been given to A. L. Anderson & Bro., Altoona, Pa., railway contractors, for building 20 miles of railway in Indiana county, Pa. The new line will be a feeder to the New York Central and will extend through rich coal fields, connecting several mining operations. The contract is worth about $250,000, and the work is to be completed this summer.

BOSTON & MAINE.—The petition of this company to the Vermont legislature to build new tracks between Brattleboro, Vt., and South Vernon, paralleling the tracks of the Central Vermont, has been amended in the senate so as to give the Central Vermont certain rights over any tracks which the Boston & Maine might build. The request of the Boston & Maine to exercise the right of eminent domain to take land in Brattleboro was refused. (April 15, p. 1014.)

BUCKHANNON & NORTHERN.—An officer writes that bids have been received for building 30 miles of line from the Pennsylvania —West Virginia state line, up the west side of the Monongahela river to Rivesville, Marion county, W. Va. The company expects to let the contract early in February. (Dec. 30, p. 1281.)

BUTTE, ANACONDA & PACIFIC.—Announcement is made that this company is planning to build an extension from Anaconda, Mont., to the Cable and Georgetown mining sections.

CALIFORNIA ROADS.—Financial arrangements are said to be made for building from Bella Vista, Cal., to Afterthought mine, at Ingot, 15 miles. T. H. Adams, Indianapolis, Ind., and G. L. Porter, Union City, Tenn., are said to be interested.

CANADIAN PACIFIC.—Authority has been given this company by the Railroad Commissioners of Canada to build a branch from Guelph Junction, Ont., on the main line, to a point near Hamilton, about 20 miles.

CENTRAL VERMONT.—See Boston & Maine.

CHICAGO, WEATHERFORD & BRAZOS VALLEY.—An officer writes that grading work is now being carried out by the Mitchell-Pigg Construction Company, Weatherford, Texas, on the line between Bridgeport, Wise county, and Gainesville. Grading has been finished on 22 miles. Track laying has not yet been started. Contracts were let recently for the ties, bridge and building material for the first section of 10 miles. Maximum grades will be 1 per cent., and maximum curvature 4 deg. L. M. Kirkes, president; F. B. Truax, chief engineer, Weatherford. (November 4, p. 886.)

COLORADO ROADS.—Plans are being made to build from Dillon, Colo., on the Denver & Rio Grande and the Colorado & Southern,

northwest to Kremmling, on the Denver, Northwestern & Pacific, about 40 miles. P. F. Reinhardt, formerly of Steamboat Springs, now of Missoula, Mont., is said to be interested.

Detroit, Bay City & Western.—An officer writes that an extension is to be built from Caro, Tuscola county, Mich., to Wilmot, 11.5 miles.

Great Northern.—J. J. Hill, chairman, is quoted as saying that construction work is to be started at once on the Midland of Manitoba, building a line from Winnipeg, Man., south to the Hill lines in North Dakota. The plans call for a line from Winnipeg, south to the international boundary, with a branch from Winnipeg, west via Brandon and Elkhorn; also a branch from Morden, northwest to a point near Rathwell, thence northwest to a point on the first mentioned line running westerly from Winnipeg.

Harriman Lines.—Announcement has been made by R. S. Lovett, president of the Union Pacific and Southern Pacific, that improvements are to be carried out during the next five years, including the double-tracking of the Union and Southern Pacific from the Missouri river to the Pacific coast, at a cost of $75,000,000. Plans for the construction of a number of extensions and new lines, to connect with the Union Pacific and Southern Pacific in the West and Northwest, which for some time have been under consideration have also been approved.

Hudson & Manhattan.—An officer is quoted as saying that construction work will be started before May 1 on the proposed extension to the Grand Central Station, New York City. (Dec. 2, p. 1097.)

Kansas, Oklahoma & Panama.—This company, which was organized last year to build from Liberal, Kan., to a point in Oklahoma, has amended its charter. The company has a capital of $1,000,000 and office at Oklahoma City, Okla. The plans call for building from Beaver, Okla., southeast to Frederick, near the Red river, thence into Texas, with a branch from Elk City, in Beckham county, Okla., east to Oklahoma City, in all, about 325 miles. The estimated cost of construction is $30,000 a mile. The directors include: J. J. Winton, R. M. Ruffin, F. A. Mosher, A. H. Syncox and J. E. Dumarr. (May 27, p. 1324.)

Knox County Central.—Application has been made in Maine for a charter to build from Friendship, Me., north via Waldoboro, Union, Hope, Lincolnville, Searsmont and Belmont, to Belfast. C. W. Stackpole, W. F. Curran and H. J. Chapman, Bangor; J. Wyman, Millbridge; F. S. Walls, Vinal Haven, and C. M Coleman, Lincolnville, are interested

La Crosse & Southeastern.—This company is making surveys for an extension from Viroqua, Wis., to Retreat, about 35 miles. A. E. Rau is engineer in charge of preliminary work, Sparta.

Lincoln County (Electric).—An extension of two years has been asked for by this company to build from Damariscotta, Me., southwest to Booth Bay Harbor.

Monongahela Railroad.—See Pittsburgh & Lake Erie.

New York Connecting.—This company, which was organized by the Pennsylvania Railroad and the New York, New Haven & Hartford, to build a line through the boroughs of Brooklyn and Queens, New York City, and over the East river on a bridge to a connection with the New York, New Haven & Hartford, at Port Morris, on the Harlem river, started work on the line in August, 1910, and on the foundations for the bridge over the East river on December 30. The plans and estimates for the important parts of the railway and bridge structures are still in the hands of the engineers, and the contracts have not yet been let.

New York, New Haven & Hartford.—The new tunnel through Sylvan hill, just west of Terryville, Conn., was opened January 28 for traffic. With the opening of this tunnel the work of double-tracking and shortening the line of the old Highland division between Waterbury and Bristol is about finished. As soon as some slight changes are made to the line east of Bristol, there will be a double-track between Waterbury and Fairfield.

Northern Electric.—An officer writes that although the necessary franchises and rights-of-way have been secured for an extension from Chico, Cal., to Redbluffs, no time has been set for carrying out the work.

North Carolina Traction.—An officer writes that a contract has been let to the Propst Contracting Company, Charlotte, N. C., to build from Winston-Salem, north to Ruralhall, thence northeast to Lawsonville, and then northwest to Floyd, Va. The work includes one 600-ft. steel bridge and several trestles. Maximum grades will be 2 per cent. and maximum curvature 12 deg. A. M. Clarke, president and H. P. MacKnight, chief engineer, Southern Pines, N. C. (See Carolina Traction, January 27, p. 183.)

Oregon Electric.—See United Railways Company (Electric).

Pennsylvania Railroad.—This company has asked permission from the authorities of the city of Rahway, N. J., to elevate its tracks and to lay additional tracks through the city. In order to provide underground crossings for highway traffic the railway company asks that changes be made in the location and grades of certain streets and that part of some streets be vacated for the railway company's use.

Pittsburgh & Lake Erie.—According to press reports, bids have been received for building an extension of the Monongahela Railroad, from Martin, Pa., south to Rivesville, W. Va., 30 miles, where connection is to be made with the Baltimore & Ohio.

Work is to be started soon, it is said, on a nine-mile connecting line between Fayette, Pa., and Dickerson Run.

Portland & Southeastern.—An officer writes regarding the reports that an extension is to be built from Albritton, Ark., to Delhi, La., about 40 miles, that the company has been making plans for this new line, but that nothing definite has yet been decided.

Port Bolivar Iron Ore.—See Atchison, Topeka & Santa Fe.

Sacramento Short Line (Electric).—This company has been incorporated in California with $10,000,000 capital, to build an electric line from Oakland, Cal., northeast to Sacramento, and to other points in Sacramento valley. Some of the incorporators are identified with the United Properties Company, and include B. M. Aikens, Gavin McNab, R. P. Henshall, L. Elkins, G. W. Mordecai and F. L. Stewart.

San Francisco, Oakland & San Jose (Electric).—This company, it is said, will build 98 miles of line into Sacramento, Cal., to connect with the Northern Electric.

St. Paul, Sioux City & South Dakota.—According to press reports, this line will be built east via Canova, S. D., Clarno and Madison, thence northeast to Marshall, Minn. C. A. McGee, Winfred, S. D., representing eastern capitalists, is said to be interested.

Texas Roads.—Residents of San Antonio, Texas, are back of a project to build a line from that place to a point in the Rio Grande valley near Brownsville. A company is to be organized with a capital of $500,000, and the promoters expect to secure a large amount of money in bonuses from residents along the proposed route. G. West, J. J. Stevens, F. L. Hillyer, G. C. Vaughan, C. A. Zilker and W. Cassin, are interested.

United Properties Company.—See Sacramento Short Line.

United Railways Company (Electric).—According to press reports, this line, which is controlled by the Hill interests, is to be extended from its present terminus to Tillamook, Wash. It is expected that the work will not be finished until 1912. The Oregon Electric, which is also a Hill line, is to be built from Salem, Ore., to Eugene, about 75 miles. Surveys have been made and it is expected to start the work soon.

Utah & Grand Canyon.—This company, which was incorporated last year to build from Lund, Utah, south to St. George, 85 miles; also, from Marysvale, south to Panguitch, 55 miles, will start construction work as soon as contracts can be let. F. A. Dudley, president, Niagara Falls, N. Y.; V. E. Huntsacker, Salt Lake City, Utah, is a director. (December 16, p. 1167.)

Waldo Electric.—An extension of two years has been asked for by this company to build from Belfast, Me., south to Camden.

Winter Harbor & Eastern.—An extension of two years has been asked for by this company to build a line from Winter Harbor, Me., north to Cherryfield.

Railway Financial News.

BUFFALO, ROCHESTER & PITTSBURGH.—A semi-annual dividend of 2½ per cent. on the common stock has been declared, payable February 15. The yearly rate for the last two and a half years has been 4 per cent.

CHICAGO, ROCK ISLAND & PACIFIC.—James McLean, of Phelps, Dodge & Co. has been made a director.

KANSAS CITY SOUTHERN.—This company has sold to Ladenburg, Thalman & Co., $5,000,000 refunding and improvement mortgage 5 per cent. bonds of 1950, being part of an authorized issue of $21,000,000, of which $10,000,000 was issued in July, 1909. The proceeds are to be used for terminal improvements, reduction of grades, additional equipment and track improvements.

NEW YORK, ONTARIO & WESTERN.—The New York Public Service Commission, Second district, has been asked to authorize the issue of $2,702,000 4 per cent. general mortgage bonds, to reimburse the company for expenditures already made and to pay for 12 locomotives now under construction. In its petition the company says that between February 1, 1907 (the date of the last issue of general mortgage bonds), and December 1, 1910, it has spent $2,751,443 for the acquisition of property, extensions and improvements. With the new issue, this would make $6,650,000 outstanding of the $12,000,000 authorized under the mortgage.

OHIO ELECTRIC RAILWAY.—This company has sold $6,000,000 6 per cent. notes through Drexel & Co., of Philadelphia, and has sold about $4,000,000 stock.

READING COMPANY.—J. P. Morgan & Co., New York, and Drexel & Co., Philadelphia, are offering at 97 and interest the unsold balance of the new $18,811,000 general mortgage 4 per cent. bonds. (January 27, page 185.)

SOUTHERN PACIFIC.—Negotiations are being carried on with French bankers for placing a large block (perhaps $50,000,000) of bonds in Paris. See Railway Construction.

SPOKANE, PORTLAND & SEATTLE.—The capital stock is to be increased from $25,000,000 to $62,500,000, and the company is to become the holding company for the Hill properties in Oregon and Washington outside of the Great Northern and the Northern Pacific.

WHEELING & LAKE ERIE.—The syndicate headed by Kuhn, Loeb & Co., which holds the $8,000,000 5 per cent. notes of this company, has agreed to extend the notes from February 1. (January 27, page 185.)

FOREIGN RAILWAY NOTES.

It is said that during 1911 work will be commenced on 1,800 miles of new railways in Russia.

The Chilean government has granted to Gibbs & Co., of Valparaiso, a concession to construct a private railway from Chucumata to the rich nitrate fields of the interior.

On November 21, 1910, the birthday of the president of Guatemala, the works of the Guatemalan section of the Pan American Railroad were formally inaugurated. The construction of this section, about 38 miles long, is in charge of the Guatemala Central Railway, and its completion is expected within 18 months.

The Minas section of the Bahia-Minas Railway, Brazil, extending from Aymore station to Theophilo Ottoni, a distance of 146 miles, has been purchased by a group of capitalists, who are authorized to use the power of the waterfalls which are found within a distance of 5 miles of the line, for the future electrification of the road.

Messrs. Amandio Fidencio Lampert and Pedro A. Gonçalves de Carvalho have obtained a concession from the Brazilian government for the construction of 63 miles of railway in the Valley of the Cahy river, extending from the Port of S. Joao de Montenegro to the boundary of the district of Caxias, in the state of Rio Grande do Sul.

Late News.

The items in this column were received after the classified departments were closed.

B. R. Moore has been appointed superintendent of motive power of the Duluth & Iron Range, with office at Two Harbors, Minn., succeeding H. S. Bryan, deceased.

F. W. Taylor, general storekeeper of the Oregon Short Line, at Pocatello, Idaho, has been appointed purchasing agent of the Pacific Electric, with office at Los Angeles, Cal.

Local trains on the Hudson division of the New York Central are now operated with electric motive power from New York City to Hastings, four miles beyond Yonkers.

J. H. Rosenstock, trainmaster of the Delaware & Hudson, at Carbondale, Pa., has been appointed superintendent of the Susquehanna division, with office at Albany, N. Y., succeeding D. F. Wait, assigned to other duties.

Winfield A. Huppuch, chairman of the New York Democratic State Committee, has been offered by the governor the appointment to the Public Service Commission, Second district, in place of N. Carlisle, of Watertown, whose term has expired.

The New York, New Haven & Hartford, it is said, will place orders shortly for 30,000 tons of rails. The Chicago, Rock Island & Pacific is said to have ordered 10,000 tons of rails. The Grand Trunk, it is said, will place orders immediately for 61,000 tons of 80-lb. rails.

Proposed advanced rates on fruits and vegetables from Chicago and Milwaukee to various destinations over the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern railways, which were to have gone into effect on February 1, have been ordered suspended until June 1.

Seven cases have been filed in the Federal District Court at Chicago against the Chicago & Alton; Chicago & Eastern Illinois; Illinois Central; Chicago & North Western; Chicago, Milwaukee & St. Paul, and the Belt Line, to recover penalties for violating the safety appliance law.

J. P. Cummings, division superintendent of the Chicago, Burlington & Quincy, at Beardstown, Ill., has been transferred to Ottumwa, Iowa, succeeding W. F. Thiehoff, who succeeds Mr. Cummings at Beardstown, Ill. The Beardstown division has been taken out of the Illinois district and put in the Missouri district, and the Centerville division has been taken out of the Missouri district and put in the Iowa district.

By an explosion of dynamite near the station of the Central of New Jersey at Communipaw (Jersey City), N. J., on Wednesday of this week, 25 or more persons were killed and property of the railway company was damaged to the extent of $200,000. It is roughly estimated that other property losses will amount to several hundred thousand dollars; hundreds of windows having been broken in the lower part of New York City, more than a mile from the explosion. The dynamite was being unloaded from a freight car on the end of pier No. 7 and was being carried into the hold of a lighter. This lighter and another vessel, with the crews of both, were so completely destroyed that none of the bodies of the men were found. A car of cement next to the car in which the explosion occurred was also destroyed, but a third car containing dynamite withstood the shock so well that its contents did not blow up, though great numbers of the sticks of dynamite were scattered about the floor of the pier. About 40 freight cars were wrecked or badly damaged. Every window in the passenger station was blown out and scores of passengers on two ferry boats lying at the slips were injured by flying splinters and glass. The force of the explosion was felt 40 miles away, north, south and east. A man in a tugboat, which was nearly a mile away from the scene of the explosion was blown out of the pilot house into the water and fatally injured. Many of the tallest buildings in the lower part of Manhattan were jarred, and in some cases, according to the stories of the occupants, they "rocked," and walls were cracked in some of them. It is conjectured that the explosion of the dynamite was caused by the explosion of a boiler of the lighter. It is said that the explosives were to be delivered for use at places in Manhattan.

Supply Trade Section.

Edwin S. Woods & Co., Chicago, have moved to larger quarters in the Monadnock building, suite 1252-54.

The Clark Car Company, Pittsburgh, Pa., has moved its offices from the Frick annex to the Henry W. Oliver building.

The Baldwin Locomotive Works, Philadelphia, Pa., has moved its St. Louis, Mo., offices from the Security building to the Wright building.

The General Railway Signal Co., Rochester, N. Y., has moved its New York offices from the Night and Day Bank building to the Liberty tower.

The McKeen Motor Car Company, Omaha, Neb., has received an order from the Ann Arbor Railroad for five 70-ft. motor cars, delivery to be made within four months.

Harold Kirschberg has resigned his position of illuminating engineer of the Pennsylvania Railroad, and is now with the Heany Lamp Company, New York, and its associated companies.

R. W. Bailey, chief sales agent in the Philadelphia district for the American Bridge Company, New York, has been made general sales manager of that company, succeeding J. A. Huston, resigned.

The Joseph Dixon Crucible Co., Jersey City., N. J., during the year 1910, supplied graphite and graphite lubricants to 210 different steam railways, increasing its business with the steam roads 53 per cent.

E. S. Taylor, who has been in the sales department of the Pullman Company, Chicago, has become associated with the Forsyth Brothers Co., Chicago. Mr. Taylor's headquarters will be in Chicago for the present.

The White Enamel Refrigerator Company, St. Paul, Minn., has opened an office on the main floor of the Steger building, Chicago, where it has on exhibition a full line of refrigerators using the Bohn siphon system.

The Indianapolis Switch & Frog Company, Springfield, Ohio, has opened a sales office in the Balboa building, San Francisco, Cal. S. I. Wailes will be in charge as coast representative. This is the sixth branch office of the company.

At the regular quarterly meeting of the board of directors of the Pressed Steel Car Company, Pittsburgh, Pa., held January 25, O. C. Gayley was made a director to fill the vacancy caused by the recent death of one of the members of the board.

Edward Blake, Jr., manager of sales and director of the Wells Brothers Co., Greenfield, Mass., has left that company to become manager of the Canadian Tap & Die Company, Ltd., Galt, Ont., of which he has been treasurer since its organization in 1905, and in which he has obtained a controlling interest.

The National Car Coupler Company, Attica, Ind., has opened a sales office in the McCormick building, Chicago, in charge of W. A. Ruth, general sales agent. The company reports much improvement in late orders for small steel castings, and now has enough orders booked to keep its plant busy for three months.

The Buckeye Steel Castings Company, Columbus, Ohio, has bought 85 acres of land at Indiana Harbor, Ind., bordering on the canal and reached by the Pennsylvania, the Baltimore & Ohio and the Indiana Harbor Belt railways. The company does not expect to build a plant in the immediate future, as has been reported, but when conditions are favorable the erection of such a plant will be undertaken.

The Electrical Testing Laboratories, New York, have installed at Eightieth street and East End avenue, additional apparatus for testing materials of construction. This includes tension and compression machines up to 200,000 lbs. capacity, a torsional testing machine of 230,000 in.-lbs. capacity, and an equipment for testing cement and concrete. This equipment is at the service of engineers, builders and the public in general.

The directors of the Crucible Steel Company of America, Pittsburgh, Pa., have perfected arrangements for the formation of the Pittsburgh Crucible Steel Company, and purchased 423 acres of the property of the Midland Steel Company, Midland, Pa., on the Ohio river, below Beaver, including the plant the company put up only a few years ago. Included in this purchase also are 1,800 acres of coal lands on the opposite side of the Ohio, and 130 acres of limestone near Newcastle. It is the intention to improve this property with plants sufficient to produce the requirements of the company in the way of the highest grades of open-hearth steel. The formation of the new company, the purchase from the Midland, and the improvements to be made will mean an expenditure of $7,500,000.

Clyde Mitchell Carr, who recently was elected president of Joseph T. Ryerson & Son, Chicago, succeeding Edward L. Ryerson as announced in the *Railway Age Gazette* of January 27, was born in Illinois, July 7, 1869. He prepared for Princeton University at the Lake Forest Academy, and was later a student in Northwestern University for two years. In addition to his connection with Joseph T. Ryerson & Son, Mr. Carr is a director of the Chicago Great Western Railroad and is also very active in Chicago civic societies, being a trustee of the Art Institute, of the Orchestral Association, the Chicago Bureau of Public Efficiency, the Chicago City Plan Commission and of Forest University. Mr. Carr is also interested in the American Iron and Steel Institute, of which he is an active member.

Clyde M. Carr

George E. Pratt, who has been in charge of sales of the Crawford Locomotive & Car Company, Streator, Ill., has been made railway representative of the Kennicott Co., Chicago Heights, Ill., with office in the Corn Exchange Bank building, Chicago. Mr. Pratt will be in charge of sales for the new railway department of the Kennicott Co., which will make steel under frames for freight and passenger equipment and complete tank cars. The company's plant at Chicago Heights is being enlarged and new machinery and tools are being installed to care for this new line.

TRADE PUBLICATIONS.

Drills and Lathes.—Joseph T. Ryerson & Son, Chicago, have issued two new circulars describing the Rockwell drill press and the Rockwell lathe.

Ingot Iron.—The American Rolling Mill Co., Middletown, Ohio, has published a 25-page booklet on American ingot iron, telling the story of the development of this product and the results of the various tests to which it has been submitted.

Telephones.—The Western Electric Co., Chicago, has devoted bulletin No. 117 to central battery telephone sets and accessories, for standard requirements. Descriptions and photographs give full information on the various types and ringing systems.

Electrical Apparatus.—Fairbanks, Morse & Co., Chicago, have published, in bulletin No. 25, a catechism on direct current apparatus. The questions and answers give definitions of electrical terms and describe the construction and uses of the electrical apparatus made by that company.

Block Signaling.—The General Railway Signal Co., Rochester, N. Y., in bulletin No. 115-B, describes the installation of the block system on the electric railway of the Washington Water

Power Company, Spokane, Wash. This was described in the *Railway Age Gazette* of December 16.

Denver & Rio Grande.—The annual review number of the Railroad Red Book, a monthly publication issued by the Denver & Rio Grande, contains 103 original articles on agricultural, mining and industrial subjects, prepared by a number of the most prominent authorities in the West.

Building Materials.—F. W. Bird & Son, East Walpole, Mass., has published a 25-page booklet on the Bird Neponset products for building purposes, describing these products and their method of manufacture. Photographs of the most prominent buildings in which these products are used are included.

Pile Drivers.—The Browning Engineering Company, Cleveland, Ohio, has published a catalog on Browning pile drivers. These machines consist of self-propelling cars, carrying pile drivers for driving piles at various angles and in any position, either close to the car or up to about 30 ft. from it. The catalog is illustrated and the descriptions are clear and concise.

The Southern Railway.—This company has published separate booklets on Alabama, Mississippi, Georgia and North Carolina. These illustrated and comprehensive little booklets should prove a valuable source of information to prospective home seekers, manufacturers and investors in those states. Detailed descriptions are included of the growth and development, the climate and soil, the agricultural and mining resources, the many industries and their centers. All this information could only have been compiled after an enormous amount of labor; the publishers should be well satisfied with the result.

RAILWAY STRUCTURES.

BRAWLEY, CAL.—The Southern Pacific is enlarging its freight house at Brawley.

BUFFALO, N. Y.—Negotiations are pending with the Erie Railroad for the elimination of grade crossings in Buffalo at eleven street crossings. The improvements proposed are to be made on the Erie from Walden avenue in the east end of the city, northwest to Military Road. At five of the crossings, from Delavan avenue to Delaware avenue, inclusive, except Main street, negotiations will be taken up for similar work on the Delaware, Lackawanna & Western, which parallels the Erie tracks. From a point near Walden avenue to north of Delavan avenue, the Erie tracks are to be raised from 9 ft. to 13 ft. on 1.5 miles, then depressed for about two miles to a point west of Main street, the maximum depression being 32 ft. through a rock cut, reducing the grade from 1.33 to 0.3 per cent. From a point east of Colvin street, westerly 3.5 miles, the tracks will be raised a maximum of about 8 ft.; at Military Road similar work is also planned to be carried out on the New York Central.

CHARLESTON, S. C.—The Carolina, Clinchfield & Ohio has made application to the Harbor Commission, it is said, for a permit to erect coal piers on the company's property at Cooper River.

COUNCIL BLUFFS, IOWA.—The Union Pacific will begin work at once on its new shops to replace the old ones in the transfer yards. The new building will be 100 ft. x 30 ft., and will include carpenter and lathe shops.

FAIRMONT, W. VA.—The Baltimore & Ohio has asked the War Department for permission to build the double-track bridge over the Monongahela river at Gaston Junction, near Fairmont. It is expected that the work will be started soon.

HARRISBURG, PA.—An ordinance has been presented to the city council of Harrisburg authorizing the construction of a steel bridge over the Philadelphia & Reading tracks at 13th street. The question of building a bridge at this place has been under consideration for a long time.

HIGH BRIDGE, KY.—The work of replacing the Queen & Crescent bridge over the gorge of the Kentucky river at High Bridge, with a structure 31 feet higher, on the same foundations as the old bridge, and without interfering with traffic, is nearing completion. This bridge is one of the highest railway bridges in the world. The increased height of the new bridge will give a much better grade at this point and its great strength will allow the use of heavier locomotives. The new bridge is to carry double tracks, and like the old bridge, was erected on the cantilever principle. It is of steel throughout on stone piers, 1,230 ft. long, with the track level 308 ft. above low water mark. About 6,900 tons of steel have been put in place, leaving some 142 tons yet to be placed, the greater part of which cannot be put in its permanent position until after the removal of the old bridge. The principal work remaining to be done consists of riveting. It is expected that riveting will be completed by March 1. The new approaches, consisting largely of high embankments on either side of the bridge, made necessary by the increased height of the structure, are about completed.

HUTCHINSON, KAN.—The Atchison, Topeka & Santa Fe has prepared plans for extensive yards and a new repair shop and round house. It is expected that work will begin early in the spring.

LARAMIE, WYO.—The Union Pacific has begun work on a 30-stall roundhouse to be built at an estimated cost of $450,000.

LOS ANGELES, CAL.—The Los Angeles Pacific is planning to construct a subway through Los Angeles for its Venice and Santa Monica lines. The estimated cost of the improvement is $10,000,000.

MARQUETTE, MICH.—The Lake Superior & Ishpeming is to erect, this spring, a large, iron ore dock, at Marquette. It will be of reinforced concrete, 1,200 ft. long, 54 ft. wide, and 75 ft. high. Its capacity will be 200 pockets, with an aggregate storage of 47,000 tons. Groups of six spouts each, for loading into vessels, will be operated by electric motor. The cost of the dock will be $1,200,000.

MATAMOROS, MEX.—Plans have been made by the National Railways of Mexico, it is said, for putting up new passenger stations at Matamoros and at Nuevo Laredo; also for replacing a number of the existing bridges on the San Luis Potosi—Tampico division, with steel structures. Work is now under way on the bridge over the Rio Grande between Nuevo Laredo and Laredo, Texas. The new bridge is being built to carry heavier rolling stock than the present structure.

NELSON, ILL.—According to local press reports, the Chicago & North Western has applied for a government permit to bridge the Illinois river.

OTTAWA, ONT.—The Canadian Northern has completed arrangements for a terminal in the city of Ottawa, it is said. At present the Canadian Northern terminal is on the outskirts of the city.

PEORIA, ILL.—The Peoria & Pekin Union has completed plans for enlarging its East Peoria yards by the laying of 33 miles of track. Eighty-pound steel will be used.

PORT ARTHUR, TEXAS.—The Southern Pacific has announced that it will build a $20,000 passenger station in the near future.

PORTLAND, ME.—The Portland Union Station Company has asked permission to increase its capital stock and to secure property by the right of eminent domain, for increasing its terminal facilities in Portland.

RACINE, WIS.—The power house and terminals at Racine, Wis., of the Milwaukee Light, Heat & Traction Company, Milwaukee, are being enlarged under the direction of Charles J. Davidson, Milwaukee, chief engineer. Two 125-k.w. low pressure units, made by the General Electric Company, Schenectady, N. Y., and one 1,500-h.p. turbine and equipment from the Union Electric Light & Power Company, St. Louis, Mo., are being installed.

SAN DIEGO, CAL.—The Atchison, Topeka & Santa Fe has been given a permit to build a new warehouse on its wharf at San Diego.

SAN LUIS POTOSI, MEX.—The National Railways of Mexico is building an addition to the combined freight and passenger station, also making additions to its shops at San Luis Potosi. The company has under consideration the question of putting up a new storehouse.

TERRELL, TEXAS.—The Texas & Pacific has ordered material for a new freight house to replace the one recently burned. Construction work will begin in February, and it is hoped to have the building ready for service by June.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Missouri Pacific is said to be in the market for 75 locomotives.

The Chicago, Indianapolis & Louisville is taking prices for three Pacific and seven consolidation locomotives.

E. F. & G. E. Fauquier, Ottawa, Ont., have ordered two ten-wheel freight locomotives from the Montreal Locomotive Works, Ltd. The cylinders of these locomotives will be 18 in. x 24 in. The diameter of the driving wheels will be 50 in., and the total weight will be 109,000 lbs.

Cavacchi & Pagano, Baker Lake, New Brunswick, have ordered one ten-wheel freight locomotive from the Montreal Locomotive Works, Ltd. The cylinders will be 18 in. x 24 in. The diameter of the driving wheels will be 50 in., and the total weight will be 109,000 lbs.

O'Brien, Fowler & McDougal, Ottawa, Ont., have ordered seven mogul locomotives from the Montreal Locomotive Works, Ltd. The cylinders of these locomotives will be 19 in. x 26 in., the diameter of the driving wheels will be 50 in., and the total weight will be 130,000 lbs.

O'Brien-McDougal & O'Gorman, Ottawa, Ont., have ordered two mogul locomotives and three ten-wheel freight locomotives from the Montreal Locomotive Works, Ltd. The cylinders of the mogul locomotives will be 19 in. x 26 in., the diameter of the driving wheels will be 50 in. and the total weight will be 130,000 lbs. The cylinders of the ten-wheel locomotives will be 18 in. x 24 in., the diameter of the driving wheels will be 50 in. and the total weight will be 109,000 lbs.

The Harriman Lines, mentioned in the *Railway Age Gazette* of December 30 as intending to build 196 locomotives, have definitely placed this order with the Baldwin Locomotive Works. The order will include 101 mikado freight locomotives, 10 mikado passenger locomotives, 8 consolidation locomotives, 12 consolidation Mallets, 12 mogul Mallets, 6 ten-wheel locomotives, 2 Pacific type locomotives, 5 American locomotives and 40 six-wheel switching locomotives. Some of the mikado locomotives will burn lignite fuel as described in the *Railway Age Gazette* of January 27, pages 150 and 167.

CAR BUILDING.

The Louisville & Nashville has ordered 100 Rodger ballast cars.

The Spokane, Portland & Seattle is in the market for 25 all wood passenger cars.

Boston & Maine has ordered 12 passenger cars from the Laconia Car Company.

The Berwind Lumber Company, Pittsburgh, Pa., is in the market for 10 40-ton flat cars.

The Louisiana Railway & Navigation Company has ordered four chair cars. This item is not confirmed.

The Kanawha & Michigan is said to be in the market for passenger and baggage cars. This item is not confirmed.

The New York, New Haven & Hartford has ordered 14 sleeping cars from the Barney & Smith Car Company.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 35 caboose cars from the American Car & Foundry Company.

The National Railways of Mexico have ordered 200 flat cars and 100 tank cars from the American Car & Foundry Company.

The Minneapolis, St. Paul & Sault Ste. Marie is said to be in the market for passenger equipment. This item is not confirmed.

The Hawley Lines, mentioned in the *Railway Age Gazette* of October 28 as being in the market for 8,000 freight cars, have withdrawn their inquiries for this equipment.

The Argentine Government has ordered 29 baggage cars from the American Car & Foundry Company. This is a part of the recent large order for cars placed by the Argentine government.

The Chesapeake & Ohio, reported in the *Railway Age Gazette* of December 21 as in the market for 200 flat cars, has ordered this equipment from the American Car & Foundry Company.

The Chilean Government is taking bids on 20 box cars, 20 coal cars, 20 flat cars, 3 powder cars, 25 metal cars, 3 first-class coaches, 3 second-class coaches and 3 baggage cars. Bids will be opened March 25 in the office of the Direcion General de Obras Publicas, Santiago, Chile.

IRON AND STEEL.

The Delaware, Lackawanna & Western is in the market for 18,000 tons of rails.

The Norfolk & Western has ordered 12,000 tons of steel from the American Bridge Company.

The Northern Electric has ordered 1,300 tons of bridge steel from the American Bridge Company.

The Chicago, Rock Island & Pacific has ordered 10,000 tons of rails from the Illinois Steel Company.

The Lake Superior & Ishpeming has ordered 5,900 tons of structural steel for an ore dock from the Wisconsin Bridge Company.

The St. Louis & San Francisco has ordered 1,000 tons of bridge steel for a draw span at Pocahontas, Ark., from the American Bridge Company.

The Isthman Canal Commission will receive bids until March 24 for miscellaneous supplies, including steel cross ties, bolts and nuts, tie clips, rail bonds, steel conductor rails, frogs, switches, etc.

The Chicago, Burlington & Quincy has ordered 30,000 tons of rails as follows: 10,000 tons from the Illinois Steel Company, 10,000 from the Colorado Fuel and Iron Company, and 10,000 from the Lackawanna Steel Company.

The Chicago & North Western has ordered 5,000 tons of bridge steel, divided as follows: 2,000 tons from the Pennsylvania Steel Company; 2,000 tons from the McClintic-Marshall Construction Company, and 1,000 tons from the American Bridge Company.

The New York Central Lines have ordered 41,500 tons of titanium bessemer rails for 1911, and have specified the use of 1 per cent. of the 10 per cent. titanium alloy (or equivalent titanium) which will therefore require more than 400 tons of the 10 per cent. alloy. The strength of the titanium content may be increased to 15 per cent., thus requiring a proportionately smaller quantity of alloy.

General Conditions in Steel.—The improvement in the steel industry since the first of January has been very encouraging, but whether this improvement is permanent or temporary remains to be seen. Orders booked by the United States Steel Corporation during January were more than a third larger than those of either December or November, and the percentage of operations has considerably increased.

FOREIGN RAILWAY NOTES.

Final plans have been accepted for the extension of a branch of the Central of Brazil Railway, connecting G. Portella with Vassouras on the Spaucahy Railway; also a short line to Itacurussa: A central branch to Monte Claros, 37 miles long will be built at a cost of $800,000, and 21 miles of main line north from Lafayette will be changed to broad gage.

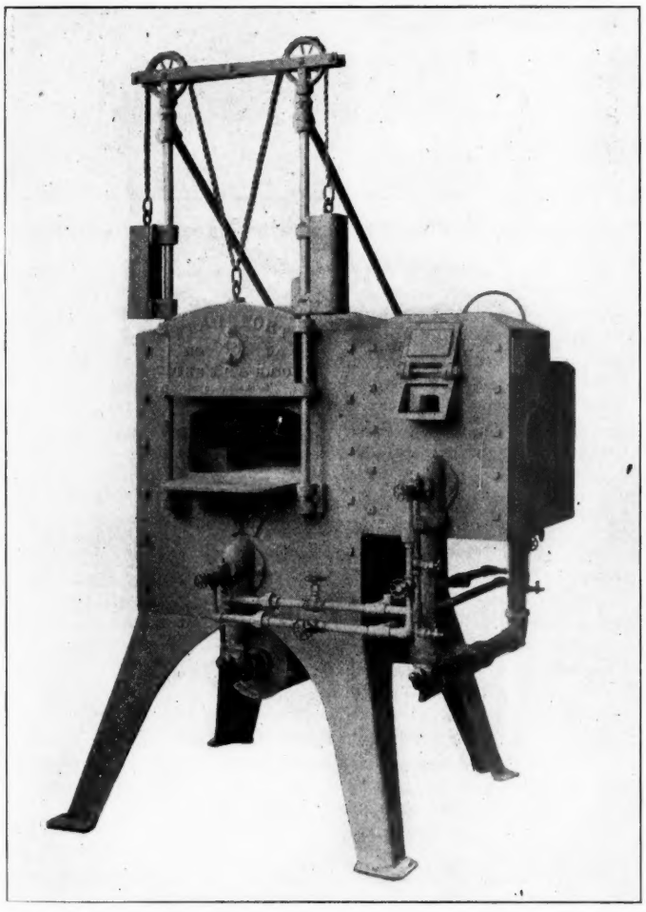
The construction of the railway line from Dean Funes, Argentina, to Laguna Paiva, a distance of 250 miles, was completed last October. This new line is of considerable importance to the development of many agricultural regions, as it extends from the coast of Santa Fe Province to Dean Funes, a town on the northernmost section of the Province of Cordoba.

Shop Equipment.

Frankfort Furnaces for Natural Gas or Oil Fuel.

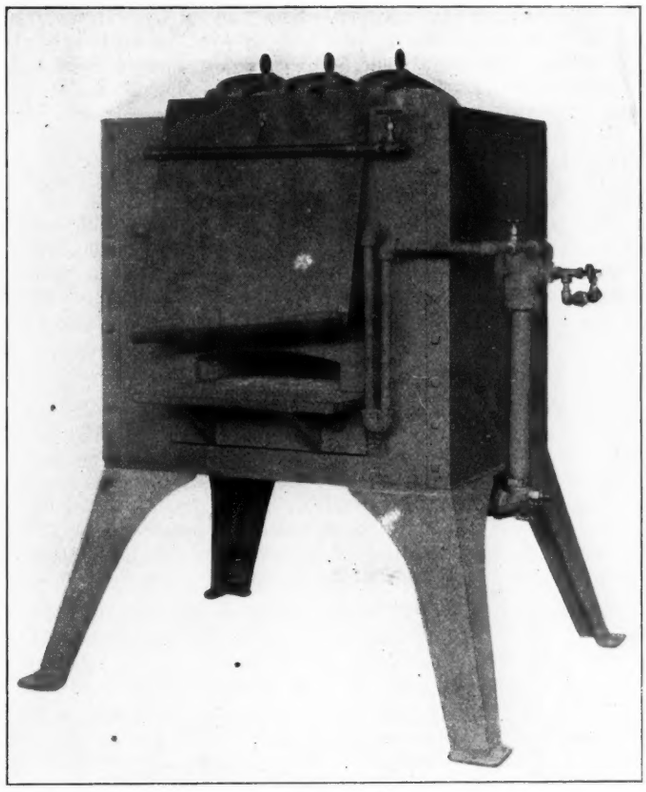
The Strong, Carlisle & Hammond Company, Cleveland, Ohio, has issued a catalog describing oil and gas furnaces which it has developed for a variety of purposes. Several of these which are specially designed for use in railway shops are here illustrated.

The No. 110 Frankfort rivet furnace has four ovens, each oven being entirely separate from the others and having its own burners and hopper. The rivets pass down an incline from the hopper to the oven so that the surplus heat may be utilized to preheat them. The control of the temperature is such that with reasonable attention to the air and gas valves over-heating may be prevented. The good combustion in the combustion chamber reduces scale or oxidation of the rivet. For natural gas there are three burners to each oven. The ovens are 20 in. wide by 24 in. deep by 15 in. high, with an entrance 20 in. by 7 in.; the floor space for the whole furnace is 65 in. by 135 in.



No. 5A—Frankfort Furnace.

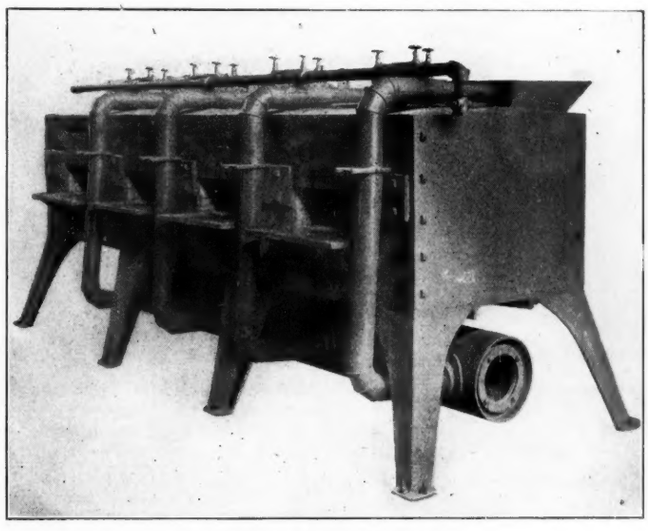
The No. 38 Frankfort forging furnace was designed for high temperatures and continuous service. The arch is made in sections, and any section may be replaced while the furnace is in full operation; the old arch clamp is refilled with brick at some convenient time. The walls of iron, mineral wool and brick reduce the heat radiation, all surplus heat being vented through ports in the roof. The front is equipped with a water shield which allows the workman to stand close to the entrance. When so ordered the furnace may be built with an air pipe which runs along the bottom of the entrance and drives the heat up behind the water shield. The oven floor slants to the center and all slag drains off through a hole in the back. The illustration shows the H. W. S. oil burner in which the oil is atomized by steam, which is superheated in the furnace walls. With slight changes in the burner the oil can be atomized by compressed air or air at 1 lb. per sq. in. The burner is large



No. 38—Frankfort Forging Furnace.

enough to heat the furnace in a short time. The oven is 24 in. wide by 12 in. deep by 18 in. high, the entrance 18 in. wide by 4 in. high, and the floor space 46 in. by 61 in. The No. 38 is an efficient furnace and will heat the material quickly and evenly.

The 5A Frankfort combination furnace is equipped for oil fuel, and is designed for tool room work, but may be used for a variety of purposes, such as annealing, case-hardening, tempering and dressing tools, and melting babbitt or other soft metals. It is adaptable for general use in the shop or factory, and although it has sufficient capacity for large work, the smallest article may be treated with economy and thoroughness. The furnace heats quickly and maintains its temperature with precision. A high or low temperature may be secured, which makes it valuable for treating high-speed steel. Owing to its unique construction, the furnace is free from oxidizing gases and direct contact with the flame is avoided. Combustion takes place under the heating oven, and a clean intense heat enters

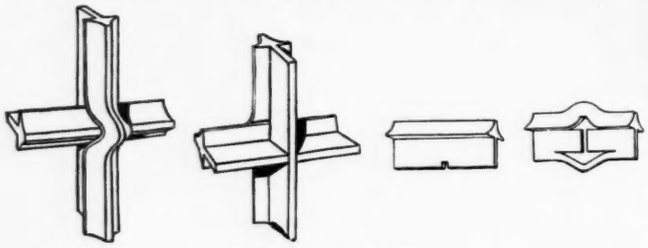


No. 110—Frankfort Rivet Furnace.

the working chamber or oven. The two ovens and melting pots are served by separate burners, working independently of each other. The small oven is intended for dressing tools and treating small articles made from high-speed steel, such as cutters, dies, taps, reamers, milling tools, drills, etc. The pot will hold about 75 lbs. of lead or babbitt and any desired temperature may be secured. The blower is mounted on brackets in the rear, which economizes in space. The principal dimensions are: entrance, large, 14 in. by 8 in.; heating chamber, 18 in. wide by 18 in. long by 11 in. high; entrance, small, 4½ in. by 3 in.; heating chamber, 4 in. wide by 6 in. long by 3½ in. high. The total height to the top of furnace is 48 in.; and the floor space is 62 in. by 53 in. The large oven has five natural gas burners or one oil burner, and the small oven, one oil or natural gas burner.

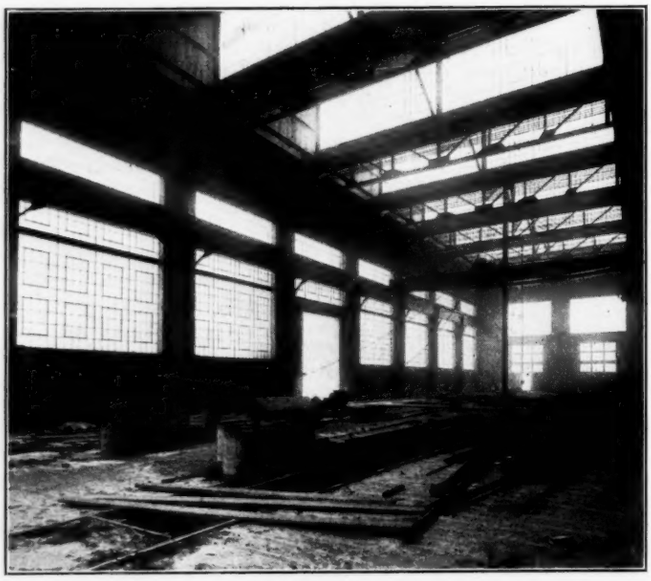
Detroit Fenestra Window Sash.

One of the conspicuous improvements in shop and factory building construction in recent years is the use of solid steel Fenestra window sash. These solid steel sash are made of rolled sections; both the horizontal and vertical members are of the same shape and area, except the frame bars, which are of a molded channel section. The muntins are connected at their intersection by the Fenestra joint, on which the efficiency depends. A small cross slot is made in the vertical bar, just wide enough



The Fenestra Joint.

to allow the flange of the horizontal bar to pass through. The molded portion is then pressed out so as to fold closely around the corresponding part of the horizontal bar. The joint is so arranged that less than 20 per cent. of the material is removed and still the bars are locked. This constitutes its chief advantage over mitre joints, where at least 50 per cent. of the material is removed, with consequent weakening of the sash. A

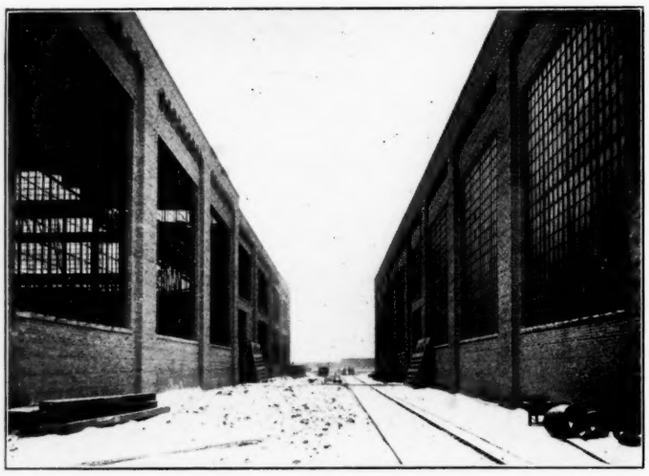


Interior View of a Shop Equipped With Fenestra Window Sash.

detail illustrating how the Fenestra joint is made and locked is shown herewith. A special connection is employed as a protection against corrosion at the wall; but no frames proper, sash weights, or heavy mullions are used. As the mullion bars are only 3-16 in. thick, there is very little obstruction to the light.

The standard sizes of sash are for 10 in. by 16 in. or 12 in. by 18 in. glass, and they are made up in various multiples of these sizes, both as to height and width.

One of the first large installations of Fenestra windows in railway shops was in that of the New York Central at West Albany, N. Y. More recent installations are in the new shops of the Duluth, Missabe & Northern at Proctor, Minn.; in the Missouri, Kansas & Texas freight station at St. Louis, Mo.; in the shops of the St. Louis Southwestern at Tyler, Tex.; in some of the later roundhouses built by the Pennsylvania Rail-



Exterior View of a Shop Equipped with Fenestra Window Sash.

road; in the new power house at the Chicago & North Western station, and in the large additions to the shops of the same company at Forty-fifth avenue. Illustrations of the interior and exterior of these shops are here given; it will be seen that Fenestra sash is used not only in the side walls but also in the saw-tooth roof, providing specially good illumination.

The American rights for the manufacture of this type of window are owned by the Detroit Steel Products Company, Detroit, Mich., and they have built a large factory at that place for its manufacture.

Jessop's Ark High Speed Tool Steel.

High speed steel since its introduction has revolutionized methods of shop operation and machine design. The steel which can endure longest under stress of deep cuts, coarse feeds and high speeds—the elements governing maximum output—is the steel that will be sought for high speed work. The question of endurance is most vital, especially when it concerns a forming tool or milling cutter, the contour of which must be preserved; the cost of material while often expensive, is of secondary importance when compared with the cost of labor on the finished tools. In all cases the value of tool steel as a factor in reducing shop expense, will be found in the time it remains in service without going to the tool dresser or grinder.

Jessop's Ark high speed steel is one that has proved its value for lathe tools, planer tools, boring tools, drilling, milling cutters, solid reamers, inserted teeth for milling cutters, threading dies, blanking and cutting dies, forming tools, planer knives for wood tools, inserted tooth saws, and other purposes in high speed work. In railway shops, where hard steel tires are a difficult proposition to cope with, whether driving wheels or car wheels, Jessop's Ark high speed steel has established a record on a modern high powered electrically driven wheel lathe, of making cuts ½ in. deep (1 in. reduction), with ½ in. feed at a speed of 17 ft. per min. The least number of tires turned under the above conditions was thirteen, with one grinding of the tool. Good results have also recently been attained in car wheel work by turning 50 wheels with one grinding of the tools. These wheels were 32 in. in diameter and very hard. The speed was 13 ft. per min., the cut ⅜ in. deep or ¾ in. reduction, and a feed of 3/16 in. Its efficiency on chrome-nickel and treated nickel steels, makes Jessop's Ark high speed steel an expense reducer in any plant. Wm. Jessop & Sons were established in Sheffield, England, in 1774, and have always kept to the forefront in point of progress. The headquarters of this company in this country is at 91 John street, New York.